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A LIST,

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AQUARIA.

LUIDIA FRAGILISSIMA.

W. ALFORD LLOYD,

AQUARIUM WAREHOUSE,

19, 20, & 20A, PORTLAND ROAD, REGENTS' PARK,

LONDON, W.

1858.

HAYMAN BROTHERS, PRINTERS, 13, GOUGH SQUARE, LONDON.

Nearly all that has been hitherto publicly written, said, or sold, relative to the Aquarium, has been characterized by the amount of inexactness, looseness, irrelativeness, and want of method, which is the usual and excusable accompaniment of that period of the early history of every new introduction, when *enthusiasm*, rather than *actual knowledge*, prevails.

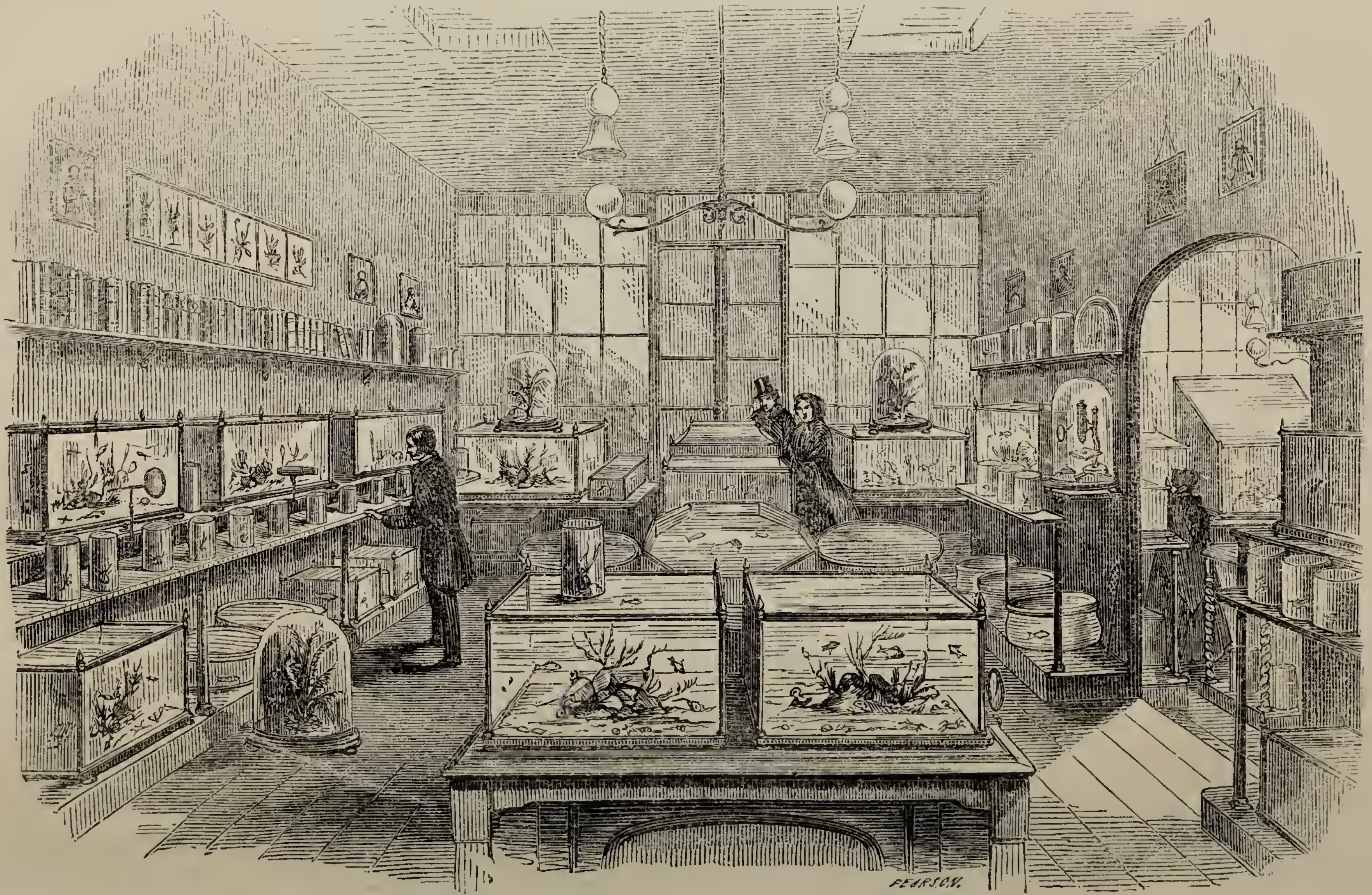
But this incipient condition has passed away; yet, at no time did the subject degenerate into a vulgar temporary "rage," nor probably will it ever do so. For, when an instinctive and strong craving for new pleasures is directed towards natural objects, these are found to be so varied and so constant in their freshness, that it is impossible for them ever to become associated with merely ephemeral fashions. The inhabitants of seas and rivers were long unsought as a means of domestic enjoyment, but, having become once cared-for in that capacity, and understood to be of easy maintenance when the few and simple conditions of their existence are complied with, it is quite contrary to all known experience that they should ever again be permanently forgotten, or neglected, or that the desire for a knowledge of them should not be continually progressive.

W. A. L.

64170

This Publication, in a much shorter form, was advertised at Sixpence. But experience increased and materials accumulated, and the desire then grew so strong not merely to enumerate, but to illustrate, to annotate, and to tell that which is told nowhere else, that the first notion was abandoned. The price, therefore, is ONE SHILLING, that being the *actual cost* of each copy.

W. A. L.



NUMBER NINETEEN, PORTLAND ROAD.

PRICE ONE SHILLING.

A LIST,

WITH

DESCRIPTIONS, ILLUSTRATIONS, AND PRICES,

OF WHATEVER RELATES TO

AQUARIA.

LUIDIA FRAGILISSIMA.

W. ALFORD LLOYD,

AQUARIUM WAREHOUSE,

19, 20, AND 20A, PORTLAND ROAD, REGENT'S PARK,

LONDON.

1858.

[ENTERED AT STATIONERS' HALL.

ADVERTISEMENT.

When Aquaria first became popular, the mode of supply of Marine Plants and Animals was from the coast direct. But the experience of a short period determined this plan to be very expensive, hazardous, and unsatisfactory. Objects when first obtained from the sea have to go through a process of selection of kind, of size, and of relative degree of hardiness, and they require much cleaning by repeated changes and washings in ample supplies of sea-water, before being fit for distribution in established Aquaria, and even then, they have to be dealt-out with great care, and according to previously ascertained capabilities for their proper accommodation. It was obviously impossible for amateurs to conform to these necessities, and whenever they were attempted to be done, or to be evaded, the loss of an entire collection almost always followed, from overcrowding; from the introduction of wrong kinds of specimens; from the non-removal of decaying portions; and from other causes. Moreover, as each locality produces only certain kinds or species peculiar to itself, no extent of variety could be obtained, unless purchasers were in communication with many collectors at several widely separated shores. This added to the complication, and it was felt that nothing would meet the difficulty but the establishment of a place where objects of all kinds, from every locality, could be sent, warehoused, and properly prepared for retail distribution; where amateurs could gradually purchase collections (or, if needed, single specimens only) of the produce of any spot, and where, if asked for, any information on the subject could always be gained, personally or by letter. Accordingly, in the spring of Eighteen hundred and fifty-five, I made arrangements for doing this, at first on a small scale, and without giving up other occupations. By Christmas, much experience (but no money) was found to have been gained, and in the following April, larger premises and more capacious Tanks were ventured upon. A list of objects, with prices, was then called for, and one of four quarto pages, but very imperfect, was issued. It served a commercial purpose, to a certain extent, however, and it was followed, early in Eighteen hundred and fifty-seven, by another one of the same kind, of smaller dimensions, and this, too, soon became exhausted. These were mere strings of names, with prices affixed, but with nothing to serve as a guide in selection—and in the enumeration of Tanks which followed, each vessel, having precisely the same form and functions, was offered to meet every contingency, however varied. At that time, only artificial sea-water could be obtained, and this, on the faith of some successful experiments, was recommended as a substitute for real sea-water. But however well the manufactured water answered in experienced hands, it was a failure in those of the general public. Therefore, a regular weekly supply of real sea-water was obtained, and the proportionate numbers of Aquarium successes—which at first were only about one in ten, and had grown to be about three in ten—immediately rose to fully five in ten. The premises were then increased; a greater number and variety of plants and animals were obtained; various appliances were gradually added to the stock, and, in the autumn of last year, this present list, of about one half of the size in which it now appears, was thought-of and promised. At about this period, however, there arose a gradually increasing conviction of the non-effectiveness of the Tanks then in use, and, on studying the matter closely, they were found to be utterly wrong in principle, chiefly in their admission of too much light, and in the absence of proper means of regulating it, for the purposes of aquatic vegetation—whether marine or fresh-water. They were not only *thus* erroneous, but they were perishable in material, and ugly in shape and design. Consequently they were at once and entirely discarded; the business was re-modelled; additional premises were taken, and better Tanks were commenced to be made on the spot, in such manner that the necessary unity of purpose between them and their intention should be kept in view. Fitness thus became to be recognized; the Tanks were still further improved; an important principle was elicited; this principle was patented; it was found necessary to enlarge the premises once more—for the fourth time—and the result now is, that the number of failures from any cause, instead of being, as at first, nine in ten, are not more than one in fifty. In a parallel line with these Tank improvements, other improvements have been going on, at much expenditure of thought, time, and money, and these various causes have resulted in continual postponements of the issue of this list. The explanation thus given is therefore offered as an apology to all who have expressed impatience or anger at the delay. Its compilation has been found a task of inordinate difficulty, as well as of considerable pecuniary expense, but, though termed "A List" merely, and though put forward as only a tradesman's catalogue, it is hoped that the hitherto unattained minuteness and clearness of detail aimed at in the following pages, will give them a certain and a real value as a book of practical instructions—chiefly on the regulation of temperature and illumination—points which were but feebly recognised, even by myself, up to less than a year ago.

Results, rather than *causes*, are here given, however, but an endeavour will be made to elucidate the latter, in a volume I am now preparing, entitled:—

AN ATTEMPT

TO EXPLAIN

THE PRINCIPLES INVOLVED IN ARRANGEMENTS

KNOWN AS

"AQUARIA."

W. Alford Lloyd.

August, Eighteen hundred and fifty-eight.

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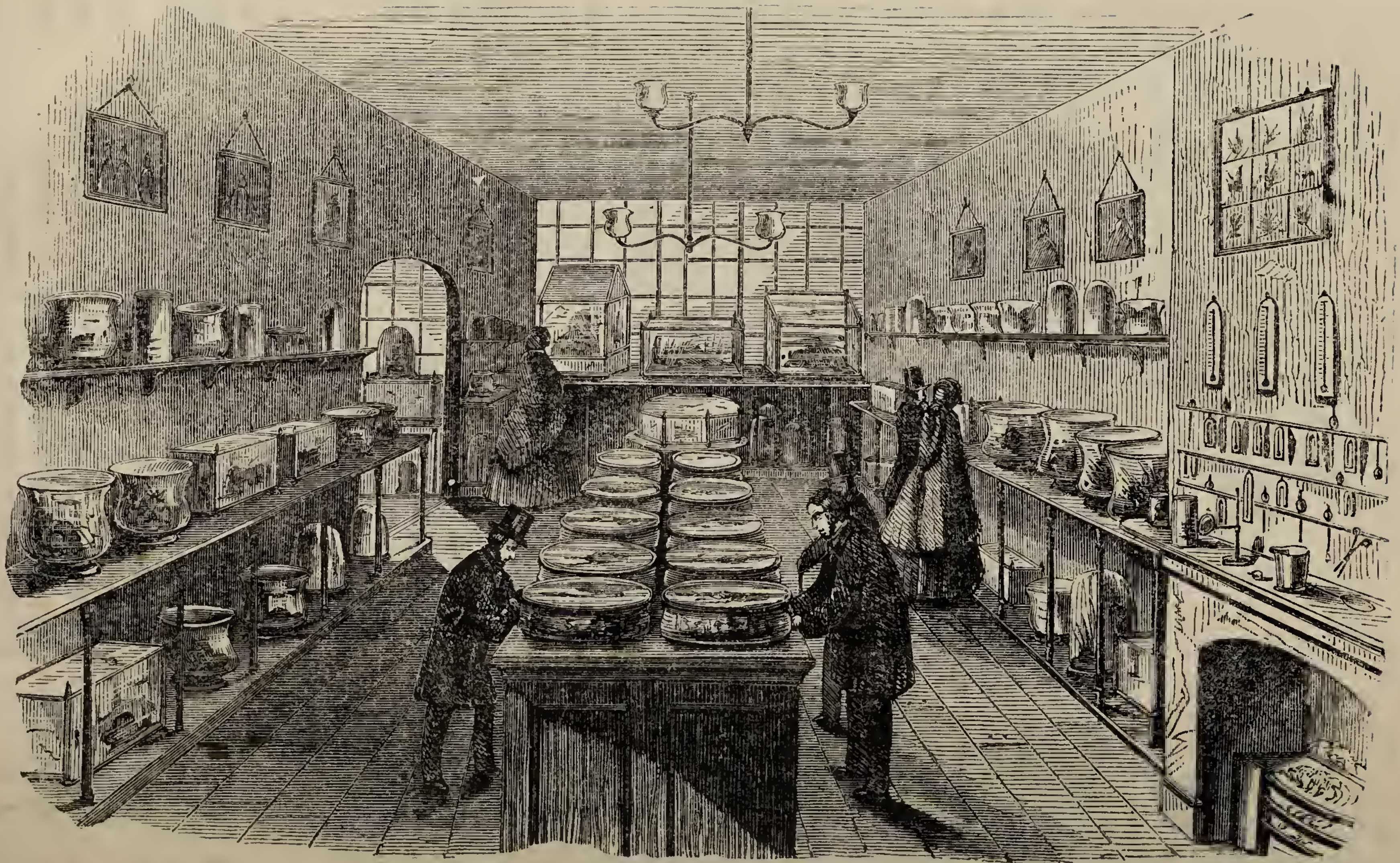

NUMBER TWENTY, PORTLAND ROAD.

GENERAL NOTICES AND EXPLANATIONS.

1. The great difference in size attained by individual specimens of the same species, in the following list of plants and animals, prevents any other than an approximate price being attached to many of them. Thus, for example, a very large plumose Sea-anemone is worth ten or twelve times the amount of a proportionately smaller one, and yet, from the nature of the animal, the difference in bulk cannot easily be expressed by weight or measure. Therefore, in giving orders, it is best to name a sum, at the same time mentioning the size of the Aquarium for which the specimen or specimens are intended, and the number of specimens (if any) already in the tank.

2. It will frequently happen that commencing amateurs will order objects of a kind not well fitted for their amount of experience, or for their means of accommodation, or that they will desire to have objects in too great numbers, or at wrong periods. In such instances, therefore, unless some special reason be assigned, an endeavour will be made to direct a better choice.

3. Many items are set down which are rare enough to cause professed naturalists to suppose that errors of identity have been made, or to give rise to a thought that the list is merely a careless compilation. But it has to be explained that the catalogue has been drawn up scrupulously on the principle of admitting nothing which has not actually occurred at least once, and which, therefore, has the same chance of occurring again. It is obvious that no line can be drawn in such cases. An asterisk (*) affixed denotes rarity, but it will be found, that this mark is set against several things which are not at all scarce as that term is usually understood in books, but only

that up to the present time the item so marked is not *commercially* plentiful. Pages 125 and 126 are left open for manuscript or other additions if needed.

4. It will sometimes happen that many items are often not in stock, especially during a few weeks of the hottest part of the year, for it would be obviously unremunerative to attempt to keep *in bulk** a great quantity of the more delicate creatures in such weather, however easily they may be maintained at any season in proper numbers, and in well established private tanks, if placed in proper situations. In commencing the formation of a collection, therefore, it is advisable not to attempt the transit of animals during a period of great heat, but to make use of that time to get the introductory arrangements completed, and the vegetation in good order. There are also some *seasonal* causes which render the number of specimens in stock fluctuating, and which also have an effect on their pecuniary value. But plenty of the more hardy animals, such as Sea-anemones, Madrepores, and Serpulæ, are always on hand.

5. Many items are named, which, being parasitic in habit, can only be offered in conjunction with others in the same mass, and even then, perhaps not fully grown, or only in course of *probable* development. But in all such probabilities, the chances are oftener that the purchaser has *more* and not *less*, than bargained for. The organisms here referred to are such minute ones as, *e. g.* Algæ in their earliest states, or of small kinds; some of the Hydroid Zoophytes, such as Clava, Coryne, and Hydractinia; the smaller of the tubiculous worms, Sabella, Sabellaria, Othonia, Spio, and Spirorbis; nearly all the Polyzoa; many of the tunicated Mollusks; and several other similar growths in fresh water, such as Hydra, Melicerta, and so forth.

6. The letters *a*, *b*, or *c*, affixed to each article, denotes its comparative hardiness or otherwise for tank purposes. Thus, *a* denotes easier to keep than *b*, while *b* is easier than *c*. When two or three letters are applied to the same item, it is meant

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* See note at page 33, however.

to imply that from some unknown cause, but probably owing to local influences, some varieties, or even identical varieties of the same species, are more or less easily maintained than others coming from different places. Thus, although in making out this list, the plan adhered-to is the before-mentioned one of admitting everything which has occurred at all, yet, the use of the arbitrary signs *a b c* will tend to prevent the vexation and loss resulting from the purchase of specimens promising but doubtful success. Among the ordinary impracticabilities may be adduced, for example, the larger marine fishes of the Wrasse family. Close to the sea they may indeed be kept with tolerable success, and in an inland situation they may be maintained with special accommodations; but in a general way, the great difficulties attending their transit, combined with the large space they require, and which cannot be afforded them in the great majority of ordinary Aquaria, render even the *attempt* to domesticate them undesirable, and the same observations apply equally to *all* other large and actively moving animals, whether Marine or Fresh-water. Yet there are a few small sea fishes generally attainable at most seasons, and which live very well, and these will be found duly marked. On the whole, however, the Marine Aquarium, if only one Tank be adopted, should be accepted as affording the means of observing the more curious forms of *sedentary* animal life, and which, therefore, require to be kept naturally quiet, while the Fresh-water Tank may be appropriately allotted to the more commonly known and quickly-moving fishes and other animals. Each receptacle, when thus properly arranged with reference to the kind of objects to be kept, has its own points of interest, and, when a *pair* of tanks are determined upon, (whether two Marine Tanks, or one Marine and the other Fresh-water) a kind of compensatory effect may be obtained. Some such classification is much wanted.

7. Following out the ideas suggested by the foregoing paragraph, it is much to be regretted that no one having means and opportunities has yet made a thoroughly adequate and systematic provision, on a large scale, for Aquaria. Almost all other

domesticated animals have accommodation carefully provided them to meet their several requirements, but aquatic creatures and plants in confinement are oftener than otherwise housed very inappropriately. Comparing land plants with water plants, this difference is yet more striking; for while there are Orangeries, and Fern-houses, and Conservatories, and Green-houses, and Hot-houses, and Palm-houses, and Orchid-houses, and even while entire buildings have been devoted to the culture of one Water Lily (the *Victoria Regia*), all being carefully planned and watched, it is very remarkable that *to the requirements of the far more interesting* LOWER *aquatic vegetations and animals, not one single building has ever been wholly and properly devoted*, so contrived in its original construction, that some classification may be carried out; that certain objects may be isolated; and, more essential than all, that the two great points of temperature and illumination be made to conform to a state of nature. This fact of the non-existence of such a separate building up to this time, is one of the strongest proofs that can possibly be adduced of the present incipient condition of Aquarian science, though it does not militate, in the smallest degree, against the practicability and perfect success of Aquaria in the inhabited apartments of dwelling houses.*

8. English names are adopted, as well as systematic names, in all cases where the former have been given on proper authority. But there are many organisms so obscure that their scientific nomenclature is the only one that can be recognized, and indeed nearly all English compound names for such objects are usually so clumsy and inexpressive that it would be well if they were disused altogether. Yet as there are many persons to whom difficult-looking Latin or Greek words are repulsive, the double recognition is printed wherever possible.

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* The Aquarium House built by the Zoological Society of London, in 1852, which has been the origin of the whole popular movement in the cultivation of this subject, was designed entirely in reference to *animals*, without any previous experiments on a large scale to indicate the best construction for the purpose in view, but the modifications which have since been adopted in this building have, to a great extent, supplied the deficiencies which became evident in practice.

9. It is particularly requested to be noticed that *the kind of Tank is not a matter which concerns merely the caprice of shape*, but that each form of vessels has its own æsthetic advantages and suitabilities for certain purposes, and more particularly for certain aspects affecting the admission of light and heat; and therefore, in all such instances where advice is required (on these or other points of experience) a written communication will most willingly be sent previously, free of expense, if some data be given on the subject by the intending purchaser, by filling up and forwarding the form printed for this purpose at pages 127 and 128. The advice and recommendation thus given does not, however, imply pecuniary or other responsibilities of any kind, unless such responsibilities be otherwise formally undertaken.

10. Aquaria are kept permanently in order, their occasional losses re-instated, and fresh arrivals of various objects introduced from time to time, such services and supplies being charged for at rates varying according to circumstances. In some cases, the charges may be so adjusted as to cover losses and risks of every kind. But as such undertakings are in their nature extremely varied, all arrangements of this kind must be made specially by agreement.

11. In all ordinary cases, risks of every kind, whether in transit or otherwise, are borne by the purchaser. These risks, however, may be considered as merely nominal, for in the course of past years very few losses or breakages have occurred in the longest journeys; but, to lessen mischances still further, in ordering animals and perishable articles generally, the nearest Railway Station should be named, and, if possible, some particular train should be specified, so that the exact time of arrival may be known, and arrangements made accordingly. Names and addresses should be written legibly and in full.

12. Tanks, sea-water, and other heavy goods are sent by "luggage train," and perishable goods,* being usually not heavy, are forwarded by "fast" or "passenger trains." But

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* Figs. 71 and 72, pp. 102 and 103.

small packages of living animals and plants of the more hardy kinds, can be safely and economically sent *by post** (especially when the weather is not very hot), great precaution being made to avoid the escape of damp by the employment of proper boxes. Animals are never sent from London into the country on Saturdays, by post or by rail, so as to avoid the chances of including Sunday detention in the journey. Most of the marine animals are transmitted, not in water, but in moist sea-weed, and the experience of several instances renders it necessary to be mentioned that such sea-weeds, being merely for purposes of packing, are not to be put into the Aquarium. Only those *attached* to stones, shells, &c., are for the tank, unless otherwise expressed. The animals generally arrive in a somewhat uninviting state, collapsed and shapeless, and often attached to the waste weed. In this condition, and being very much smaller than when expanded and settled, some might be overlooked. The packing material should therefore be carefully searched, and the creatures be placed in a shallow vessel of sea-water whence they may be taken in the course of an hour or less, and placed in their permanent home—the tank. This applies only to Anemones, and in thus lodging them temporarily, it is well to place them on their faces, upside down, that they may not attach before they are required. Many Fresh-water animals are also sent packed in moist vegetation.

13. Packing-cases, Baskets, and Casks for Tanks, Glasses, and other articles; Sea-water Casks and Bottles; and Bottles and Jars for the conveyance of animals and plants, are charged, and are to be paid for at the full value, subject to an allowance (on their actual return† and re-delivery in good condition at No. 20, Portland Road, Regent's Park, London, within a fortnight from the date of invoice) of from one half to five sixths of the amount of charge, according to the kind of package, and to the extent it can be used again for similar purposes; but the proportion will always be written on the invoice, or upon a

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* Fig. 73, p. 103.

† Railway Companies usually return "empties" free.

separate printed notice. It is requested, however, that the proportion so marked be not deducted by the purchaser if a remittance be sent before the articles are returned or before they have time to be re-delivered, but that the allowance be made a matter of account. The object of making this arrangement is, that Railway Companies are usually in the habit of not returning empty packages till a certain bulk of them is collected. Such articles being provided at considerable expense for the accommodation of customers, are understood to be in their charge and at their risk, even when by any irregularity of railway or other carriers, or by any other cause, they are not duly re-delivered. But to prevent such irregularities as much as possible, printed labels or tickets to identify the returner will be provided whenever a return is wished for.

The same rule applies to articles borrowed personally, or through servants, or town-carriers, but in this case, the full value of the article so borrowed, must be deposited in money, for which a receipt will be given, together with a printed return-label or ticket, such label or ticket, and receipt, to be produced when the deposit money is applied for.

Packing-cases, &c., of the value of a shilling and under, need not be returned. Goods requiring cartage are not delivered free, such cartage being charged for at the rate of 1s. 6d. per hour.

14. Terms of payment.—Cash upon or before delivery, or a satisfactory reference to a London correspondent.

Cheques and Drafts should be "crossed."

Money-orders may be made payable at Great Marylebone Street.

Postage or Receipt-stamps may be remitted for amounts not exceeding ten shillings.

15. In order to discountenance as much as possible the evils of credit-giving, a discount of five per cent. will be made on goods of every kind if paid for within one week of delivery of invoice.* If an account stands unpaid for a period exceeding

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* A larger discount is allowed on books. (See page 111.)

three months after delivery of invoice, five per cent will be *added* to it. If not paid till after six months after delivery of invoice, ten per cent will be *added.* Thus the advantages of ready money, and the disadvantages of credit, are equally divided between the buyer and seller.

16. But, as such an arrangement as the foregoing cannot be easily carried-out in work done by contract, and extending over a period of time, it is understood that a payment on account, approximating to one-half of the probable cost of the whole, be made when the work is half-done, and the remaining one-half be paid in a week after completion, subject to the deductions or additions before referred to.

LIVING MARINE SPECIMENS.

Pages 19 *to* 33.

" SCIENCE has always advanced, and it has been found necessary to admit that a greater number of generalizations which had been taken for granted or recognized as facts thirty years ago, require in our own day a most severe revision. From hence has arisen that special interest which belongs to the study of long-neglected animal groups ; and hence, also, has emanated a spirit of emulation which brings the naturalists of all countries to the sea-side, in search of the objects of their study. The marine faunas bear, indeed, very little resemblance to those of the land, or air, or freshwater. The sea contains entire groups belonging to special types, which have no representatives elsewhere. Here live almost exclusively those singular beings which are often of considerable size, although the animal organization is reduced to its simplest expression, seeming almost as if they were objects fitted by the hand of nature for elaborate experiments in physiology, and which it is sufficient to know, recognise, and interpret. *It is here more especially, that we must seek those animals of abnormal external forms and exceptional organic arrangements, which open to the student of nature vast and ever-varied fields of inquiry.*"

QUATREFAGES.

MARINE PLANTS.

Much difficulty has been experienced in the formal enumeration of the lower and more humbly organized green sea-weeds (Chlorospermatous Algæ), such as Lyngbya, Oscillatoria, Bangia, Conferva, Vaucheria, and some others, in the ensuing list, because, although they can be, and are, supplied,* they may be best depended upon as coming spontaneously and in the course of time, either from spores or seeds held invisibly in sea-water, or from hidden germs abounding upon what are here provisionally termed "composite masses," such masses being dredged stones, shells, old bottles, crockery, &c., which, by having been long submerged in the sea, or long kept in Aquaria before being sold, are found to abound in numerous growths, in germ, or fully developed. These usually consist of both minute red as well as green weeds, as well as of many forms of animal life, such as Zoophytes, tubed Worms, Polyzoa, sedentary Mollusks, &c., and therefore these observations apply equally to the "composite masses" mentioned under the head "Marine Animals." See also paragraph 5, page 10.

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* Whatever may be the extent of the ensuing, or of any other list of sea-weeds, desirable for the Aquarium, the small amount of knowledge we as yet possess of their systematic culture renders them somewhat uncertain. Fortunately, however, as far as actual usefulness is concerned, this is but of little consequence, as it is upon the lowest and most minute filamentous Algæ (kept in proper check by regulating the light) that every one depends for a *lasting* supply of oxygen, and for the means of maintaining the general health of the Aquarium. Therefore, a Tank is kept at Portland Road, for the purpose of propagating such Algæ, and a little of this sent by post (price one shilling) is sufficient to clothe the rock-work of the largest Aquarium with green vegetation, in a few weeks, particularly if the stones be of the kind mentioned at page 44. A similar vase for filamentous fresh-water Algæ is also kept, see page 37. This process is analogous to that carried on by bakers and brewers in the formation (growth) of *yeast*, which is also a plant (Torula), though a Fungus, not an Alga.

The kinds of sea-weeds known as Porphyra (purple laver), Ulva (green lettuce-weed), and Enteromorpha (sea-gut), also require separate mention, inasmuch that they have hitherto been indiscriminately recommended in large masses, and as the *only* proper vegetation for Marine Aquaria. This statement requires great modification, because these plants are very much influenced by the depth and localities of the places where found, and thus, when of certain varieties or conditions of growth, or when a Tank is placed in a certain aspect, they may be the very worst Algæ which can be placed in an Aquarium, and under any circumstances, but very few of them are required even in the largest tanks. The specimens kept in stock are therefore carefully selected, and the position of the Aquarium ascertained before the time of sale.

But it has been recently ascertained that the *red* sea-weeds—Rhodosperms—can be maintained and grown with as much ease as was formerly supposed to apply only to the higher green kinds, the reasons for this change of opinion being that the proper parts of the sea coast whence such red weeds might be obtained, had not till lately been discovered, and also that the form of Tank best suited for the growth of these plants had not been well ascertained. On the importance of selecting the kind of Tank so as to be in accordance with varying circumstances, see pages 12, 45, &c.

The olive sea-weeds (Melanospermeæ) are as yet inapplicable for Aquarium purposes.

Microscopic Algæ, such as Desmidiacæ, Diatomaceæ, and their allies, may be found parasitic on the larger kinds, or they are sold in separate phials for the convenience of microscopists. Whenever the season admits, phials and jars of muddy and other deposits are kept ready for sale. The contents of twenty-four jars (twelve sea-water and twelve fresh-water) labelled for each month of the year, holding monthly skimmings and deposits from localities known to be rich in organisms of this kind, are retailed at sixpence per ounce bottle, and these can be sent by post for sixpence extra.

SYSTEMATIC NAME.	ENGLISH NAME.
CHLOROSPERMEÆ.	GREEN SEA-WEEDS.
Oscillatoria Lyngbya Bangia Conferva Vaucheria } *a.*‡	And other allied forms, are either sold palpably, or they grow from spores on other objects. See foot-note to page 19.
Porphyra laciniata. *a.*	The laciniated Porphyra, or purple Laver, or Sloke.
Ulva lactuca. *a.*	The lettuce Ulva.
Ulva latissima. *a.*	The very broad Ulva.
Enteromorpha compressa. *a.*	The compressed Enteromorpha.
,, intestinalis. *a.*	The intestinal Enteromorpha.
Cladophora rupestris. *a.*	The rock-inhabiting Cladophora
,, lætevirens. *a.*	The pale green Cladophora
†Bryopsis plumosa. *a, b, c.*	The feathery Bryopsis.

† Of very uncertain growth, and often in combination with other things.

RHODOSPERMEÆ.	RED SEA-WEEDS.
Callithamnion arbuscula *a.*	The bush Callithamnion.
,, Turneri. *a.*	Turner's Callithamnion.
,, polyspermum. *a.*	The manyseeded Callithamnion.
,, pluma. *b.*	The feather Callithamnion.
Griffithsia setacea. *a**.§	The bristly Griffithsia.
,, corallina. *a.*	The coral-like Griffithsia.
Ceramium rubrum. *a.*	The red Ceramium.
Ptilota sericea. *a, b.*	The silken Ptilota.
Irideæ edulis. *a, b.*	The edible Irideæ, or Dulse.
Furcellaria fastigiata. *a.*	The pointed Furcellaria.
Polyides rotundus. *b, c.*	The round Polyides.
Gymnogongrus plicatus. *a.*	The entangled Gymnogongrus.
,, Griffithsia. *a.*	Griffiths's Gymnogongrus.
†Phyllophora rubens. *b, c.*	The red Phyllophora.

† Abounds in parasitic animals.

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‡ For the use of letters affixed to each item, see paragraph 6, page 10, but they have a more variable value when applied to sea-weeds, because their condition alters materially at different seasons.

§ For the use of an asterisk affixed to some items, see paragraph 3, page 9.

SYSTEMATIC NAME.	ENGLISH NAME.
Phyllophora Brodiæi. *b**	Brodie's Phyllophora.
,, membranifolia. *a, b.*	The membrane-leaved Phyllophora
Chondrus crispus. *a.*	The curled Chondrus.
Several varieties.	
Chondrus Norvegicus. *a.*	The Norwegian Chondrus.
Gelidium corneum. *a.*	The horny Gelidium.
Grateloupia filicina. *b.*	The fern-like Grateloupia.
Hypnea purpurescens, or Cystoclonium purpurescens. *a.*	The purple Cystoclonium.
Gracilaria confervoides. *a.*	The conferva-like Gracilaria.
Plocamium coccineum. *c.*	The scarlet Plocamium.
Rhodymenia ciliata. *a.*	The ciliated Rhodymenia.
,, laciniata. *b.*	The laciniated Rhodymenia.
,, bifida. *c.*	The cloven Rhodymenia.
Delesseria alata. *c.*	The winged Delesseria.
,, sanguinea. *c.*	The blood-red Delesseria.
Hildenbrandtia rubra. *a.*	The red Hildenbrandtia.
Melobesia polymorpha. *a.*	The many-shaped Melobesia.
,, calcarea. *a.*	The chalk Melobesia.
,, membranacea. *a.*	The membranaceus Melobesia.
,, pustulata. *a.*	The pimpled Melobesia.
The four preceding are commonly known as "Nullipores."	
Jania rubens. *a.*	The red Jania.
Corallina officinalis. *a.*	The medicinal Coralline.
Laurencia pinnatifida. *a, b.*	The pinnatifid Laurencia.
Polysiphonia elongata. *a, b.*	The divaricate Polysiphonia.
,, nigrescens. *a.*	The blackish Polysiphonia.
Rytiphlæa pinastroides. *a.*	The pine Rytiphlæa.
Rhodomela subfusca. *a, b.*	The brownish Rhodomela.
,, Lycopodioides *a.*	The Lycopodium Rhodomela.
Dictyota dichotoma. *b.*	The forked Dictyota.

The preceding vary in price from 6d. to 5s. each, according to individual sizes, fineness of specimen, season, rarity, and extent of combination with other organisms, whether vegetable or animal. A stone or shell (a "*composite mass*") rich in young Algæ, and covered with Zoophytes Annelides, Ascidiæ, &c., is worth from 6d. to 7s. The usual price of single seaweeds is 4d. and 6d.

MARINE ANIMALS.

In this division, "composite masses" (pages 10, 12, 19, 22,) are also enumerated, and they are of the same nature and price as the foregoing.

SYSTEMATIC NAME.	ENGLISH NAME.
Infusoria, various species. *a*	Infusory animals.
Come spontaneously, or are introduced with other objects.	
Foraminifera of various species. *a*, *b*.	Chambered shells.
Occur with other things—chiefly with Corallina officinalis.	

⁎ Bottles and jars arranged with Infusoria, Rotifera, &c., usually kept ready, see p. 20.

ZOOPHYTA.	ZOOPHYTES.
Clava multicornis. *a*. Usually as parasites. Hydractinia echinata. *a*. Generally with Hermit-crabs. Coryne sessilis. *a*. Tubularia indivisa. *c*. ,, larynx. *b*. Sertularia—various species. *b*, *c*. Antennularia antennina. *c*. Laomedea geniculata. *b*. ,, gelatinosa. *b*. Hydra tuba. *a*. Usually is developed in the Tank.	No accredited English names.† See Notice, No. 8, page 12.

The nine preceding items are of microscopic size, and occurring chiefly in conjunction with other things, they must not be calculated upon separately. They are often abundant at one period of the year, and but sparingly at other times. Many are supposed to be but larval conditions of higher forms. Price from 6d. to 2s. 6d. per mass, according to state of combination and size.

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† Where no English names are recognised, the space is left blank.

SYSTEMATIC NAME.	ENGLISH NAME.
ACTINIADÆ.‡	SEA-ANEMONES.
Anthea cereus. *a*, *b*, *c*.	The furrowed Anthea.

Three varieties of colour—green; green, with arms tipped with lilac; and gray.

Adamsia palliata. *c*.*	The cloak Anemone.

Occurs with Prideaux's Hermit-crab (Pagurus Prideauxii), and with the parasitic Anemone (Sagartia parasitica).

Corynactis Allmanni. *a*	Allman's Corynactis.
,, viridis. *a*.	The green Corynactis.
Sagartia viduata. *a*. (formerly Actinia anguicoma)	The snake-locked Sea-Anemone.

Several varieties of markings of disk.

Sagartia Troglodytes. *a*.	The Snipe's Feather Sea-Anemone, or "the burrowing Sea-Anemone."

At least ten varieties in colour and in markings, from nearly white to decided orange, all the colours being occasionally united in one individual, in bands and stars. In size, also, it is very variable, and the adults from one coast greatly differ from the fully-grown specimens of another spot. Very hardy.

Sagartia aurora, *a*.	All hardy.	The orange tentacled Sea-Anemone.
,, pallida. *a*.**		The pale Sea-Anemone.
,, rosea. *a*.*		The rosy Sea-Anemone
,, nivea. *a*, *b*.		The snowy Sea-Anemone.
,, miniata. *a*, *b*.		The scarlet-fringed Sea-Anemone.
,, venusta. *a*.		The orange-tentacled Sea-Anemone.
† ,, sphyrodeta, (formerly *S. candida*). *a*.		The purple-spotted Sea-Anemone.

† Very small.

,, parasitica. *c*.	The parasitic Sea-Anemone.

Most commonly with the Hermit-crab, and often in twos and threes on the same shell. In such cases they cannot be separated, and must be sold together.

Sagartia bellis. *a*.	The daisy Sea-Anemone.

More hardy, more prolific in confinement, and by far more variable in colour, markings, and external outline, than any other species. The hue varies from very pale ash to very dark olive, almost black, nearly every intermediate shade being represented. Keeps open nearly constantly.

Actinoloba *(formerly Sagartia)* dianthus. *a*,*b*.	The carnation Sea-Anemone. The plumose Sea-Anemone.

Seven or more varieties, viz.:—Pure white; flesh colour; vivid orange; sulphur colour; dark olive brown; pale brown; pale brown with cream colour tentacles and disk.*

The largest and most ornamental of all the British Sea-Anemones. Varies in dimensions when fully expanded, from sixteen inches, to half an inch in height, according to age.

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‡ The enumeration on this and the next page is set-down in the order as found in Mr. Gosse's "Manual of Marine Zoology"—but not as finally placed in that gentleman's "History of British Sea-Anemones and Madrepores," now publishing.

SYSTEMATIC NAME.	ENGLISH NAME.
Bunodes gemmacea. *a*, *b*.	The gemmaceous Sea-Anemone.
,, thallia. *a*.**	The glaucous-warty Sea-Anemone.
,, clavata. *a*, *b*.*	The clubbed, or Weymouth Sea-Anemone.

Four varieties, viz.:—Pure waxy white; dark ashy gray; pale transparent rose*; greyish white, with tentacles tipped with rose.

Tealia crassicornis. *c*.	The thick-horned Sea-Anemone.

Several varieties, from pure white* to very dark. Very common, and very handsome, but seldom lives in a tank for more than a few weeks, except occasionally in winter, and is therefore not recommended.

Actinia mesembryanthemum. *a*, *b*, *c*.	The smooth Sea-anemone.

Four or more varieties, viz.:—Dark or light red or liver coloured, passing into livid purple. Very light: a "dirty" or "veiled" white.* Striped vertically (sometimes called *Act-vittata**). Spotted: known popularly as the "Strawberry Anemone," and sometimes called scientifically *Actinia fragacea*, and *Actinia punctata;* but neither of these three Latin names have, up to the present time, been universally accepted as current.

Cerianthus membranaceus. (formerly *Edwardsia vestita.*) *a*.*	The Clothed Sea-Anemone.

Two varieties—light ashy grey, and dark olive.

CARYOPHYLLEADÆ.	MADREPORES.
Cyathina Smithii. *a*, *b*. (formerly *Caryophyllea Smithii*).	Smith's Madrepore.

Several shades of colour, from very pale straw to vivid green.

Balanophyllea regia. *a*.	The Golden Madrepore.

Both of these are occasionally met with in clusters of two, three, or four, or even more (especially Balanophyllea). In such instances no separation can safely be made, and the mass can only be sold as a whole. So also with Corynactis.

The foregoing Sea-Anemones and Madrepores range in price from 6d. to 7s. per specimen, according to variety and size, and degrees of hardiness. Thus, the large and difficult *Tealia crassicornis* is only 6d. or 9d., while a specimen of *Actinoloba dianthus* (easily kept) of the same size, would be 4s; but unless specially ordered, no larger *A. dianthus* are kept than the 2s. 6d. size. Such Anemones as *Sagartia viduata*, *S. troglodytes*, &c., being not very variable in dimensions, are 1s., 1s. 6d., 2s., and 2s. 6d. Others, as *S. nivea*, *S. miniata*, which do not commonly occur, are 1s. 6d. to 3s. Another group, consisting of *S. venusta*, *Bunodes gemmacea*, &c., average 1s. to 2s. The common *Act. mesembryanthemum* is from 2d. to 6d. Madrepores are 1s. and 1s. 6d. each, and in proportion for groups. (See paragraph No. 1, page 9.)

SYSTEMATIC NAME.	ENGLISH NAME.
Alcyonium digitatum. _b._	Dead Man's hands.

A compound Zoophyte, occurring in amorphous masses, much varying in size, and generally of two colours—white, and pale orange. Does not last long. 6d. to 2s. 6d.

Medusæ of various species. _b._	Jelly-fish, or Sea-blubbers.

Occur occasionally in sea-water, being accidentally introduced; or they appear from among Algæ, and in such cases are not charged for, but sometimes specimens are purposely got, of :—

Cydippe pomiformis. _b._ (_or Beroe._)	The Sea-Lemon.

6d. to 1s.

ECHINODERMATA.

STAR-FISHES; SEA-URCHINS, OR SEA-EGGS; SEA-CUCUMBERS; SEA GHERKINS.

Comatula rosacea. _c._* *	The rosy Feather Star.
Ophiura texturata. _c._	The common Sand Star.
Ophiocoma rosula. _b, c._	The common Brittle Star.
Uraster rubens, _b._	The common Cross-Fish.
Cribella oculata. _b._*	The eyed Cribella.
Solaster endeca. _b._*	The purple Sun Star.
Solaster papposa. _b._	The scarlet Sun Star.
†Asterina gibbosa. _a._	The gibbous Starlet.

† The most hardy and the smallest of all the British star-fishes.

Echinus sphæra. _a, b._	The common Egg-Urchin.
Echinus miliaris. _a, b._	The purple-tipped Egg-Urchin.
Pentacta pentactes. _a, b._	The angular Sea-Cucumber.
Cucumaria communis. _a, b._*	The common Sea-Cucumber.
Sipunculus Bernhardus. _a._	The hermit Sipunculus.
Priapulus candatus. _c._* *	The tailed Priapulus.

Such of the above Echinoderms as have no asterisk affixed are from 6d. to 1s. 6d. each, except Pentacta, which is 1s. to 3s., the size varying the price. Those with one asterisk are 2s., and those with two asterisks are 5s.

ANNELIDA.

WORMS, FREE AND IN TUBES.

†Eurylepta vittata. _a._*	The lined Paper-worm.

† This is not a true worm, but a _planaria_, and is placed here only for convenience. So also of some of the Nemertinæ, _b, c,_* as :—

Nemertes Borlasii. _b, c._*	Borlase's Nemertes.

	Pontobdella muricata. *a.*	The Sea-Leech.
t.	Pectinaria Belgica. *c.***	The Gold-Comb.
†*t.*	Sabellaria alveolata. *a, b.*	The honeycomb Sabellaria.

† Occurs in masses of greatly varying size, and also upon many shells, and with Serpulæ. (See par. 5, page 10.)

	Flemingia plumosa. *b.***	The plumed Flemingia.
t.	Terebella conchilega. *a, b, c.*	The Conchologist Worm.
†*t.*	Sabella Lloydii. *a.*‡	Lloyd's Sabella.
	† Excessively hardy.	
t.	Sabella vesiculata. *b, c.**	The vesiculated Sabella.
t.	,, tubularia. *a.*	
t.	,, volutacornis. *a, b.**	
t.	,, à sang vert. *c.*	The green-blooded Sabella.
†*t.*	Serpula contortuplicata. *a.*	

† The most popular of all the tube worms, and the most showy. Masses occur containing from one to six or eight tubes each, usually associated with various other forms, such as Sabella, Sabellaria, Polyzoa, Tunicata, &c. (See par. 5, page 10.)

t.	Serpula triquetra. *a.*	The crowned Serpula.
	Very hardy.	
t.	Spirobis communis. *a.*	
	Microscopic.	
t.	Spio seticornis. *a.*	
	Microscopic.	
	Phyllodoce viridis. *c.*	The green-leaf Worm.
	Nereis bilineata. *b.*	The two-lined Nereis.
	With Hermit-Crabs.	
	Polynoe cirrata. *b.*	The cirrated Polynoe.
	Aphrodita aculeata. *b. c.*	The prickly Sea-Mouse.

Twelve of these Annelides live in tubes of their own making, and the letter "*t*" is prefixed to them. It is very difficult to give prices, because they usually occur in aggregated masses, sometimes to the extent of eight or ten species, and a hundred individuals, in one mass. Various interesting and minute Algæ, very effective in the production of oxygen, are almost always associated with such masses, or become developed in course of time. Therefore, only an *idea* of cost can be named in setting down 1s. 6d. to 10s. per mass, according to size and amount of life. *Serpula contortuplicata* is 1s. and 1s. 6d. per tube. Other tube worms with asterisks are more. The remaining items in the list, being free, are from 6d. to 5s. (See pages 10, 19, 22, 29.)

ROTIFERA. WHEEL-BEARING ANIMALS.

All the creatures of this class are of microscopic size, and will be constantly found in well-kept tanks, without being intentionally placed there.

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‡ Named provisionally, on the authority of Dr. Thomas Williams, of Swansea, March, 1858.

SYSTEMATIC NAME.	ENGLISH NAME.	
CRUSTACEA.‡	CRABS, PRAWNS, SHRIMPS, &c.	
Pycnogonum littorale. *a.*		
Entomoscaca, of various species. *a.*	Shell Insects.	
Idotea. *a.*		
Gammarus. *a.*		
Mysis. *a.*		
Talitrus. *a.*	The Sand-Hopper.	

The above half-dozen minute Crustaceans are inserted merely as commonly occuring representatives of many more similar objects, hiding among sea-weeds and other objects; but too small to be usually charged for as saleable stock.

Palæmon serratus. *a.*	The common Prawn.	4d., 6d., to 1s. 6d.
Pandalus annulicornis. *b.*	The Æsop Shrimp.	1s. 6d.
Crangon vulgaris. *b.*	The common Shrimp.	1d., 2d., 3d.
Homarus vulgaris. *c.*	The common Lobster	6d. to 1s. 6d.
Ebalia Pennantii *a, b.* *	Pennant's Ebalia.	3s.
Pagurus Bernhardus. *a.*	The common Hermit-Crab.	4d., 6d., to 1s. 6d.
† ,, Prideauxii. *a.**	Prideaux's Hermit-Crab.	2s.

† With Adamsia palliata.

Galathea strigosa. *c.*	The spinous Galathea.	6d.
Porcellana platycheles. *a. b.*	The hairy Broad-claw, or "Porcelain Crab."	6d. to 1s.
Pinnotheres pisum. *c.*	The common Pea-Crab.	2d.
Pinna veterum. *c.*	The pinna Pea-Crab.	2d.
Portunus depurator. *b.*	The cleanser Swimming-Crab.	1s. and 1s. 6d.
,, puber. *a.*	The velvet Swimming Crab.	1s., 1s. 6d., 2s.
Portumnus variegatus. *b.**		2s.
Carcinus Mænas. *a.*	The common Shore-Crab.	1d., 2d., 3d., 4d., to 1s.
Pilumnus hirtellus, *c.**	The Hairy-Crab.	2s.
Xantho florida. *a.**	The Florid-Crab.	2s. 6d.

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‡ To be kept successfully, most of the Crustacea certainly require separate maintenance. A Lobster of twelve inches in length should have exclusive possession of a fifty-gallon Tank.

SYSTEMATIC NAME.	ENGLISH NAME.	
Cancer pagurus. *a.*	The common edible Crab.	2d., 4d. to 1s. 6d.
Maia squinado. *b.*	The spinous Spider-Crab.	2s. 6d.
Stenorhynchus phalangium. *c.*	The long-legged Spider-Crab.	2s.

Of the foregoing Crustacea, most of those marked *b*, *c*, and *b**, *c**, are kept in stock only in winter, or in cold weather. (See par. 4, page 10.)

CIRRIPEDIA.	BARNACLES.	
Balanus balanoides. *a*, *b*.	The common Barnacle.	6d. to 1s.
„ porcatus. *a.*		6d. to 1s.
†Pyrgoma Anglicum. *a.*	† On Madrepores.	1s. 6d.

ARACHNIDA. MITES.

Parasitic, or with other things occasionally, and not charged for.

POLYZOA. {MINUTE MOLLUSCOUS ANIMALS LIVING IN AGGREGATIONS.

Scruparia chelata. *a.*	
Flustra foliacea. *a.*	The leaf-like Flustra.
Membranipora pilosa. *a.*	
Lepralia (several species). *a*, *b*, *c*.	
Serialia lendigera. *c.*	
Bowerbankia imbricata. *b.*	

The foregoing half-dozen are named merely as examples of interesting microscopic animals, occurring incidentally with other objects, or making their appearance spontaneously from hidden germs in well kept tanks. They are best purchased in properly arranged jars, but these cannot be sent into the country fitted up.

TUNICATA. {ASCIDIANS; OR, MOLLUSCOUS (SOFT-BODIED) ANIMALS WITH LEATHERY OR GELATINOUS COATS.

Botryllus polycyclus. *c.*
Sydnyum turbinatum. *a.*
Clavelina lepadiformis. *a*†.

SYSTEMATIC NAME.	ENGLISH NAME.	
Ascidia virginea. *a.*†		
,, intestinalis. c.		
,, vitrea. *c.*		
Cynthia quadrangularis. *b.*†		

Five out of these seven (especially those marked †) are in the habit of developing in the Aquarium from hidden sources upon the composite masses mentioned at pages 10, 19, 22, 27, and, being thus produced and gradually acclimated, have a far better chance of doing well than specimens placed in the Aquarium in an adult state. When occurring separately, 6d. to 5s. each. But figures approximate very roughly.

CONCHIFERA.

BIVALVES: MOLLUSCOUS ANIMALS) (SHELL-FISH) ENCLOSED IN TWO VALVES.

†Pholas dactylus. *b.*	The Piddock.	6d. to 2s.

† In masses, in perforated rocks.

Mya truncata. *b.*	The Gaper.	1s., 1s. 6d.
,, arenaria. *b.*	The Clam.	1s., 1s. 6d.
†Saxicava rugosa. *b.*		6d. to 1s. 6d.

† Same habits as Pholas dactylus.

Solen siliquosa. *c.*	The Razor-Shell.	6d.
Cardium echinatum. *c.*	The spinous Cockle.	6d.
,, edule. *c.*	The edible Cockle.	1d., 2d.
Modiola modiolus. *a.*	The bearded Mussel.	6d., 1s., 2s.
†Mytilus edulis. *a, b.*	The edible Mussel.	1d., 2d.

† When not market specimens, these are often encrusted with interesting parasitic objects.

Pecten opercularis. *a, b.*	The eyed Pecten.	2d., 6d. to 1s. 6d.
,, varius. *a, b.*	The varied Pecten.	6d. to 1s. 6d.
†Anomia ephippium. *a.*	The perforate Oyster.	1s. 6d. to 3s. 6d.

† Commonly attached to other objects, and inseparable. Usually combined with Serpulæ and other similar forms.

†Ostrea edulis.	The edible Oyster.	2d., 6d. to 1s. 6d.

† When not shop specimens, oysters have generally Serpulæ and other matters of interest upon the shells.

SYSTEMATIC NAME.	ENGLISH NAME.
GASTEROPODA.	BELLY-FOOTED MOLLUSCOUS ANIMALS (SNAILS AND SLUGS).
Eolis coronata. *b.*	The crowned Eolis.
Doris tuberculata. *c.*	The Sea-Lemon.
,, pilosa. *b.*	
Pleurobranchus plumula. *b.**	The plumed Pleurobranchus.
Ancula cristata. *c.**	The crested Ancula.
Aplysia punctata. *c.*	The Sea-Hare.

The above six items, consisting of sea-slugs, are only to be had at certain seasons of the year. They are of evanescent character. 6d. to 2s.

Chiton cinereus. *a.*	The ashy Coat-of-mail.
,, fascicularis. *b.*	The tufted Coat-of-mail.
Patella vulgaris. *b, c.*	The common Limpet.
Haliotis tuberculata. *c.*	The Ear-Shell or Ormer.
Trochus cinerarius. *b, c.*	The Ashy Top.
,, granulatus. *c.*	The Granulated Top.
,, ziziphinus. *b, c.*	
Littorina littorea. *a.*	The common Periwinkle.
,, rudis. *a.*	
,, littoralis. *a, b.*	The little yellow Periwinkle.
†Rissoa (several species). *a, b, c.*	

† These are very minute shells and frequently crawl out of Algæ—Corallina officinalis, especially.

Aporrhais pes-pelicani. *c.**	The Spout-Shell.
Turritella communis. *c.**	
Natica monilifera. *c.**	
Cypræa Europæa. *b, c.**	The European Cowry.
Purpura lapillus. *a.*	The purple, or Dog-Winkle.
Nassa reticulata. *a.*	The Dog-Whelk.
Buccinum undatum. *c.*	The common Whelk.
†Murex erinaceus. *a.*	The Rock-Shell.

† The shell of this snail is usually found peculiarly rich in numerous parasitic forms, such as several kinds of Algæ, Hydroid Zoophytes, Tubiculous annelida, &c., and it should never be thrown away, even when the animal has died. Let the animal be carefully picked out in case of death and the empty shell replaced in the Aquarium upon a rock, not on the sand or shingle.

The foregoing nineteen snail-like animals are excessively variable in cost and size, varying from 1d. to 3s. each. The letters and asterisks affixed, will afford some information on this point.

PISCES.	FISHES.
Raia. *c.*	The Skate.
Scyllium canicula. *c.*	The Dog-Fish.
Syngnathus acus. *c.*	The great Pipe-Fish.

SYSTEMATIC NAME.	ENGLISH NAME.	
Syngnathus lumbriciformis. *b.*	The worm Pipe-Fish.	2s.
Anguilla acutirostris. *a.*	The sharp-nosed Eel.	1s. 6d., 2s.
Lepidogaster Cornubiensis. *b.*	The Cornish-Sucker.	1s. 6d., 2s.
,, bimaculatus. *b.*	The two-spotted Sucker.	1s. 6d., 2s.
Solea vulgaris. *c.*	The common Sole.	
Platessa vulgaris. *b, c.*	The common Plaice, Flounder, or Dab.	
Labrus maculatus. *c.*	The ancient Wrasse.	
Crenilabrus cornubicus. *c.*	The corkwing Wrasse.	2s., 2s. 6d.
Callionymus dracunculus. *c.*	The sordid Dragonet.	
Gobius Ruthensparri. *a.*	Ruthensparr's Goby.	6d., 1s., 1s. 6d.
,, minutus. *a.*	The little Goby.	6d., 1s.
Blennius ocellaris. *a.*	The butterfly Blenny.	
Murænoides guttata. *a, b.*	The Spotted Gunnel or Butter-Fish.	1s. 6d.
Mugil capito.	The grey Mullet.	2s., 2s. 6d.
†Gasterosteus pungitius. *b.*	The ten-spined Stickleback.	
,, spinachia. *b, c.*	The fifteen-spined Stickleback.	1s. 6d.
Cottus bubalis. *c.*	The Bull-Head.	2s.

† Found both in salt and in fresh water.

It is particularly wished to be observed, that of the above list of twenty Sea Fishes,‡ not more than four, (or certainly not more than six, even in the winter season), and those only of small size, can safely be kept in even a large tank if it is *also* stocked with its compliment of other creatures. Very few of them are practicable to be kept as ordinary sale stock; and their carriage in transit being both hazardous and expensive, they can for the most part be supplied only to order, *and when it is ascertained that proper accommodation is ready prepared*

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‡ Here again, classification and separation is much wanted. See foot-note, p. 28.

for them. Marine Fishes are best kept in tanks allotted to them alone. They should always be of small size, never nearly so large as the gold and silver fishes ordinarily kept in globes or vases. The observations, at page 11, apply to these with emphasis, as well as to most Crustacea and some Mollusca. Price from 6d. to 3s. for those not otherwise marked.*

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* While these pages are printing, an apparatus, for containing the sale stock, has been set up, consisting of a large shallow tank, divided into compartments, and provided with a pump and a nearly constant stream of sea-water passing through it. The effect is, already, that a larger variety of creatures can be kept with greater ease than heretofore. This arrangement has incidentally afforded a most convincing proof of the very great value of a system of classification, and of the desirableness of separating active or mischievous creatures from those which are quiescent or harmless.

LIVING FRESH-WATER SPECIMENS.

Pages 37 *to* 42.

"When I happen to visit a family where gold and silver fishes are kept in a glass bowl, I am always pleased with the occurrence, because it affords me an opportunity of observing the actions and propensities of those beings with whom we can be but little acquainted in their natural state. Not long since, I spent a fortnight at the house of a friend where there was such a vivary, to which I paid no small attention, taking every occasion to remark what passed within its narrow limits."

White of Selborne, a.d. 1781.

FRESH-WATER PLANTS.

Contrary to the advice ordinarily given in books, the *Algæ, and not the higher forms of vegetation*, are the most effective and the most lasting, all the year round, in fluviatile Aquaria, with two or three exceptions. Therefore, the nearer the fresh-water plants can be chosen from their relation in the scale to marine vegetation (which is with one exception entirely crpytogamous) the more success there will be. Very many failures with fresh-water tanks may be attributed to the often vain endeavour to cultivate the higher and more difficult forms, which, in their decay in their due season, are the source of turbidity in the water, of deposits of decomposing flocculent matter, and of death to the animals, while the really useful and spontaneously growing minute plants, such as the *Confervæ* and their allies, are regarded as "pests" and "weeds," and exterminated accordingly. It is true that they will often grow too fast, but that is only when the source of control (light) is not properly understood. Three-fourths of the number of the larger and higher fresh-water plants usually recommended, should be struck out of the list.

At the same time, as it cannot be expected that, from their want of experience, the general public will concur with this opinion immediately, it has been found necessary to yield to popular prejudice to a certain extent, and thus it is wished to be understood, that, in the following enumeration of plants, all those marked *b* and *c* are protested against.

Those marked † and ‡ are sought by microscopists, and such as have ‡ affixed are generally kept ready mounted in clear thin glass tubes, for the purpose of shewing the circulation of the sap. Price 1s. each; by post, 1s. 6d.

FRESH-WATER PLANTS.

Jars and, vials of Desmidiæ, Diatomaceæ, ready arranged, as in marine specimens, page 20.

SYSTEMATIC NAME.	ENGLISH NAME.
Confervæ, various species. *a.*†	Silk-threads, or Crow-threads.
Oscillatorieæ, various species. *a.*†	Oscillating plants.
Vaucheria ungeri. *a.*†	

The above, with many others, usually come spontaneously in time, or they may be palpably introduced.—See page 19.

Hydrodiction utriculatum. *c.**	The Water-Net.
Chara vulgaris. *b.*‡	The common Stone-wort.
Nitella flexilis. *b.*‡	The flexile Nitella.
,, translucens. *b.*‡	The translucent Nitella.
Lemna minor. *a.*†	The little Duckweed.
,, trisulca. *a.*†	The three-lobed Duckweed.
,, polyrhiza. *a.*†	The many-rooted Duckweed.
Potamogeton crispus. *b.*	The curly Pond-weed.
,, densus. *b.*	The opposite leaved Pond-weed.
Stratiotes aloides. *c.*	The Water-Soldier.
Hydrocharis Morsus-Ranæ. *a.*†	The Frog-Bit.
Anacharis alsinastrum. *a.*	The American Water-weed, or Water-Thyme.
Valisneria spiralis. *a.*‡	The spiral Valisneria.

The best and most lasting of all Aquarium plants, 6d. and 1s. per root.

Callitriche verna. *b.*	The water Star-wort.
Hottonia palustris. *c.*	The water Violet.
Myriophyllum spicatum. *b.*	The spiked Water Milfoil.
Nymphea alba. *b.*	The white Water Lily.
Nuphar luteum. *b.*	The yellow Water Lily.

The foregoing are from 1d. to 3s. per lot or per plant, according to size and other circumstances.

FRESH-WATER ANIMALS.

SYSTEMATIC NAME.	ENGLISH NAME.
RADIATA.	**RAYED ANIMALS.**
Hydra vulgaris. _a._	The common Hydra.
,, viridis. _a._*	The green Hydra.
,, fusca. _a._*	The brown Hydra.

These do not occur in autumn or winter. They are often incidental with plants, and not seen when first put in the Aquarium.

Infusoria, various species. _a._	Infusorial Animalcules.
Rotifera, various species. _a._	Wheel-bearing Animalcules.

These, and numerous other microscopic creatures, are conveniently grouped together, not because they are related in classification, but in size. They appear spontaneously, or from hidden germs.

ANNELIDA.	**WORMS.**
Planaria nigra. _a._	The black Planaria.
,, lacteus. _a._	The white Planaria.

These and other Planaria, are Entozoa, rather than true Annelida. They occur adherent to water-plants.

Nais filiformis. _a._*	The water Hair-Worm.
Gordius inquilinus. _a._	The restless Gordius.

Parasitic on the animals of shells of the Lymnea family.

Hæmocharis piscium. _b._	The Fish Leech.

Parasitic on Pike, Carp, &c.

Various other species of Leeches (such as the Geometrical Leech) but not the medicinal Leech. _a._

CRUSTACEA AND ARACHNIDA.	**SHELL-FISH, MITES, AND SPIDERS.**
Astacus fluvialis. _b._	The Cray Fish.
Asellus aquaticus. _a._	
Gammarus pulex. _a._	

Daphnia, Cyclops, Argulus, (a fish Parasite) and other microscopic Crustaceans, usually appearing spontaneously from germs, or from plants in which they have hidden. _a._

SYSTEMATIC NAME.	ENGLISH NAME.	
Argyroneta aquatica. *a.*	The diving Water-Spider.	3d.
Hydrachna geographica. *a.*	And other Water-Ticks.	1d., 2d.

INSECTA.	INSECTS.	
Hydrous piceus. *a.*	The large Water-Beetle, commonly known as "the Harmless Beetle."	1s. each or 2s. per pair.
Dyticus marginalis. *a.*	The carnivorous Water-Beetle.	2d.
Pælobius Hermannii. *a.*	The Screech Beetle.	2d.
Hydrophilus caraboides. *a.*		2d.
Colymbetes, various. *a.*		
Gyrinus natator. *a.*	The Whirligig Beetle.	6d. per doz.
Nepa cinerea. *b.*	The Water-Scorpion.	2d.
,, linearis. *b.*	The Stick Nepa.	6d.
Notonecta glauca. *b*, *c.*	The Water-Boatman or Boat-Fly.	2d.
Phryganea grandis. *c*, *b.*	The Caddis Worm.	1d., 2d.
Libellula depressa. *a.*	The Dragon-Fly (Aquatic Larva and Pupa of).	2d., 4d., 6d.

And many other Insects at proper seasons, both in the larval and in the fully developed states.

MOLLUSCA.	SHELL-FISH (MUSSELS AND SNAILS).	
Aleyonella stagnorum. *b.* Microscopic.	The "Bell Flower," or "Plumed Polyp," of Baker.	1s. to 3s.

And others of the fresh-water Polyzoa occasionally, with their eggs. In season, in summer and autumn.

MOLLUSCA.	SHELL-FISH (MUSSELS AND SNAILS).	
Anodon cygneus. *b.*	The Swan Mussel.	2d.
Unio margaratifera. *b.* ,, pictorum. *b.*	The Duck Mussel.	2d.

SYSTEMATIC NAME.	ENGLISH NAME.	
Dreissina polymorpha. *b.*	The many-shaped Dreissina.	4d.

The last two are frequently spun together by a byssus.

SYSTEMATIC NAME.	ENGLISH NAME.	
Cyclas corneum. *c.*		1d.
Limnea stagnalis	The pond Mud-Shell.	6d. and 9d. per dozen.
,, auricularis. *a.*	The eared Mud-Shell.	6d. and 9d. per dozen.
Planorbis corneus. *a.*	The horny Coil-Shell.	6d. and 9d. per dozen.
,, carinatus. *a.*	The keeled Coil-Shell.	6d. and 9d. per dozen.
Physa fontinalis. *a.*	The stream Bubble-Shell.	6d. and 9d. per dozen.
Ancylus fluviatilis. *c.**	The fresh-water Limpet.	4d. each.
Paludina vivipara. *a.*	The viviparous Paludina.	6d. per dozen.
Bithinia tentacula. *a.*	The tentacled Bithinia.	6d. per dozen.

REPTILIA.	REPTILES.	
Emys Segriz. *a.*	Segriz's Water Tortoise.	5s., 7s. 6d., 10s.
Rana vulgaris. *a.*	The common Frog.	1d., 2d.
Lissotriton punctatus. *a.*	The common smooth Water-Newt.	2d., 3d.
Triton cristatus. *a.*	The crested Triton.	3d., 4d.

In the spring, the larval forms of the three last named are kept in stock. They are then known as "Tadpoles."

PISCES.	FISHES.	
Gasterosteus trachurus. *a.*	And other species of Stickleback.	
Cottus gobius. *c.*	The Miller's Thumb.	6d.
Cyprinus carpio. *a.*	The common Carp.	2d., 6d.

SYSTEMATIC NAME.	ENGLISH NAME.	
Cyprinus gibelio. *a.*	The Prussian Carp.	2d., 6d.
,, auratus. *a.*	The Gold Carp, or "Gold Fish."	6d., 9d., 1s.
The Silver Fish, and Black and Gold Fish, and Black and Silver Fish are domesticated varieties of this species.		
Barbus vulgaris. *c.*	The common Barbel.	6d., 1s., 1s. 6d.
Gobio fluviatilis. *b.*	The Gudgeon.	2d. 4d.
Tinca vulgaris. *a.*	The common Tench.	3d., 6d.
Leuciscus rutilus. *b.*	The Roach.	2d., 3d.
,, vulgaris. *b, c.*	The common Dace.	2d., 3d.
,, alburnus. *c.*	The Bleak.	2d., 3d.
,, phoxinus. *a.*	The Minnow.	1s. per dozen.
Cobitis barbatula. *a.*	The Stone Loach.	2d., 3d.
Perca fluviatilis. *c.*	The Perch.	4d., 6d.
Esox lucius. *a.*	The Pike or Jack.	6d. to 3s.
Anguilla latiorostris. *a.*	The Grig Eel.	3d., 4d.
,, mediorostris. *a.*	The Snig Eel.	3d., 4d.
Abramis brama. *b.*	The Bream.	4d. to 1s.

* * *

To fresh water fishes belong some of the remarks that are applied to marine species at page 32, except that the former are cheaper, and as they are for the most part procured in the neighbourhood of London, supplies can be obtained more frequently. They should always be of small size. There are but very few Aquaria large enough for the permanent support of fishes six inches long in unchanged water, excepting eels.

SEA-WATER. (REAL.)

Two thousand gallons of real sea-water, perfectly clear and pure, of the specific gravity about 1·026° at 60° Fah^{t}., are kept in stock, and sold in any quantity, large or small, at sixpence per gallon if in purchasers' own vessels, or, if in the seller's vessels, (*in quantities of not less than six gallons*) a small per-centage is charged for their loan, wear and tear, according to the following scale:—

	s.	d.
A six gallon bottle	4	0
A nine gallon cask	5	3
A twelve gallon cask	7	0
An eighteen gallon cask	10	6
A thirty-six gallon cask	21	0
A fifty-four gallon cask	31	6
A ninety gallon cask	52	6

These rates do not include the deposit of value of bottles or casks; but, in these instances, the *full* amount of deposit is returned. See par. 13, page 14.

Including delivery, free of charge, within one mile of Portland Road, or to the nearest Railway or Parcels Office, with booking, and the usual return fee.

The vessels do not injure the water — they being made purposely for the service.

Purchasers sending their own stone-ware jars or bottles must enclose them in wicker-work or in hampers, as Railway Companies and other carriers will not convey them back unless so protected. In sending casks, they must be properly hooped and otherwise quite sound.

Ten days' notice is required when more than ninety gallons are wanted at one time.

SEA-WATER. (ARTIFICIAL.)

No other but real sea-water is advised to be used for Aquarium purposes, because all artificial compounds require a long preparation by the growth of sea-weeds in them, before they are fit for the reception of animals. But the following are kept in stock to supply whatever small demand there still is for them, and they are set down in their order of comparative merit, as ascertained by experiment.

Hains's formula (fluid) in quart bottles at 2s., and in pint bottles at 1s. 3d., each quart making about four gallons by the addition of fresh water and table salt according to printed directions on each bottle.

Gosse's formula (dry), 1s. per pound packet, each making about three gallons.

Warington's formula (dry), 1s. 6d. per pound packet, each making about three gallons.

Brew and Schweitzer's evaporated preparation (dry), 1s. per pound packet, each making about three gallons.

On account of the deliquescent nature of the last three items, it has been found necessary in wet weather to convert them into concentrated (saturated) solutions, to be afterwards diluted. No artificial sea-water should be mixed by the measurement of the bulk of water added, but by the specific-gravity test, or the hydrometer. See page 98, figs 59 and 60.

* * *

ROCK, SAND, AND SHINGLE.

Mica schist, in suitable masses, according to size, from 3d. to 1s. per mass.

This stone is better adapted for the growth of Algæ, and for rock-work for Aquaria generally, both marine and fresh-water, than granite or any other kind of stone. Must be scrubbed with a brush and rinced before using.

Prepared cement, not affected by sea-water, and not requiring long soaking, for fixing rock work. In canisters, with directions, 6d. and 1s.

River-sand and Sea-sand, in bags. Half a gallon bag 6d., one gallon bag 1s.

River-shingle and Sea-shingle, in bags. Half a gallon bag 6d., one gallon bag 1s.

Sand and shingle must be well washed by stirring in running water, before being used.

TANKS AND OTHER VESSELS.*

NOTICE RESPECTING TANKS.

The evils formerly felt and complained of in tanks were chiefly these:—

1. Not the smallest attention was paid in the general form and construction, to adapt certain kinds of tanks to certain places. All were made alike, to suit every position, and consequently very serious errors of choice were being constantly made by purchasers.

2. The proportions were usually not such as to secure the largest amount of health to the greatest number of specimens in the smallest space.

3. The material of which the frames were made was corrodible, or brittle, being of iron, zinc, or brass; the glass sides were generally not thick enough, and the bottom was commonly either metal or a thin friable slab of roofing slate.

4. Their whole construction was not strong and rigid enough to bear the long continued pressure of a bulk of water. Frequent leakages and occasional burstings were the consequence.

5. The grooves by which the joints were made, were cut on a wrong principle—a very serious error.

6. No provision was made for the cover as a necessary portion of the tank.

7. Too much glass was used, and too little opaque material.

8. They were not sufficiently ornamental to suit advancing requirements.

But, in the tanks now offered, the whole of the above mentioned points have been carefully and separately considered, and a very great improvement has been the result; so that a tank is not now, as formerly, a mere vessel for the purpose of

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The word "*Tank*" is in these pages used to signify any angular flat-sided vessel, built up of several portions. A "*Slope-back Tank*" is one in which the back inclines at an angle of about 25° to the base. A "*Rectangular Tank*" has all its *inside* angles right angles. "Other vessels" have their sides variously curved. An "*Aquarium*" is any of these receptacles fitted up complete.

holding water, but something contrived and planned for special objects.

All possible information will be given on the kind of Tank best adapted for certain positions or purposes, both by the form printed at pages 127 and 128, by written communications, or by personal visits.

The width has been increased so as to expose a larger surface to the action of the air, and while the height has been somewhat reduced, the pressure of the fluid has been thus lessened.

Above all, metallic substances are carefully avoided, and, with the exception of a few small screws (hidden) outside, the whole of the materials are now slate and plate glass for the larger tanks, and slate and thick flatted sheet glass for the smaller sizes: thus, not only is there no possibility of the smallest corrosion from the action of sea water, but there is not the slightest yielding or bending, and moreover, the rates of expanding and contracting are so nearly equal in these two substances, (slate and glass) that the fracture of the glass by alternations of temperature acting on the iron or other metal to a greater extent than on the former, is necessarily avoided.

Every tank is invariably sent out with a plain glass cover for the exclusion of dust, but made in two or more pieces, for the admission of air and for the facility of removal, and arranged so as to drop into a cavity.

The perfect *fitting* and absolute identity of size in the joints and other parts, is secured by the employment of steam machinery.

Fig. 3.

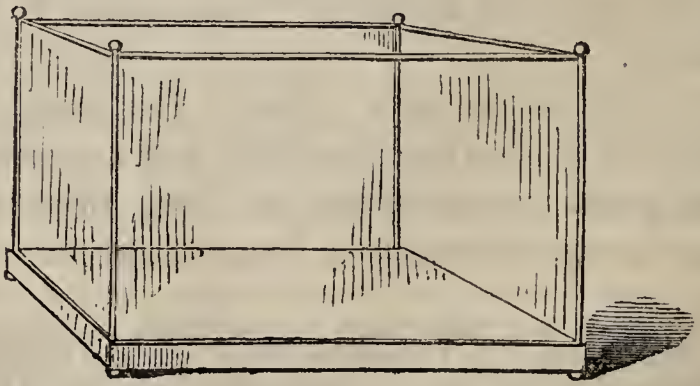

Fig. 3. Is a Tank as formerly and as still usually made, with

thin iron, zinc, or brass columns and top-rails, upon which the glass is merely *abutted* as on a shoulder, but not *inserted*, thus causing continual leakages, compared with

Fig. 4.

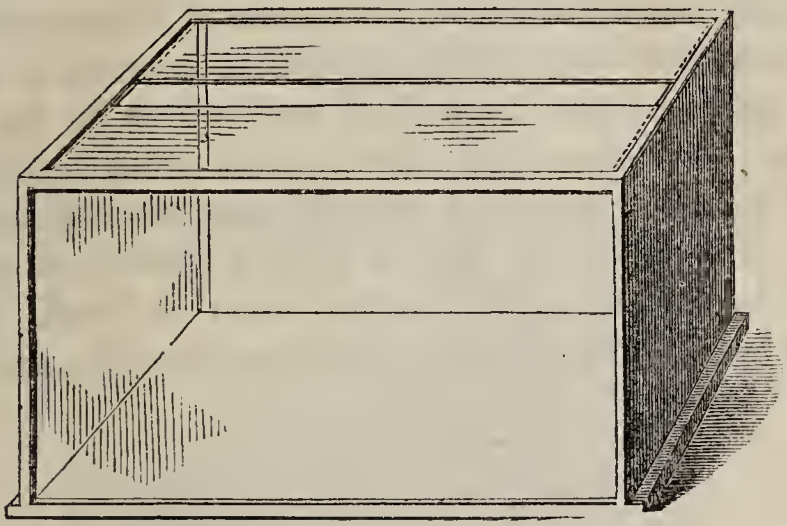

Fig. 4. The Tank now introduced, in which the glass is let into a deeply sunk groove cut in the solid slate, firmly wedged in on both sides, and secured by a slightly elastic cement.* It is evident, even to persons not accustomed to calculate strength of materials, that the Tank shewn in fig. 3 is wholly inadequate to sustain the continuous pressure of such a bulk of water as would fill it. Sea-water weighs ten pounds avoirdupois to a gallon, and therefore a Tank holding twenty gallons must contain two hundred pounds weight of water: consequently no folly, in its way, can be greater than the construction of Tanks to look and to weigh as light as possible. Any vessel destined to hold a large bulk of water continuously, must be strong, *and strength implies weight*, in such materials as are alone available for Aquaria.

The object aimed at and attained in the construction of the Tanks about to be described, is THE PROPER MODIFICATION AND REGULATION OF THE AMOUNT OF SOLAR LIGHT AND HEAT, in such manner as to secure the well-being of the contents under nearly self-acting circumstances, and without any change of the water being necessary. It is to the want of some such contrivance as that here referred to, that most Aquarium failures may be traced, as the most formidable difficulty to be contended against is excessive heat and light during the summer season.

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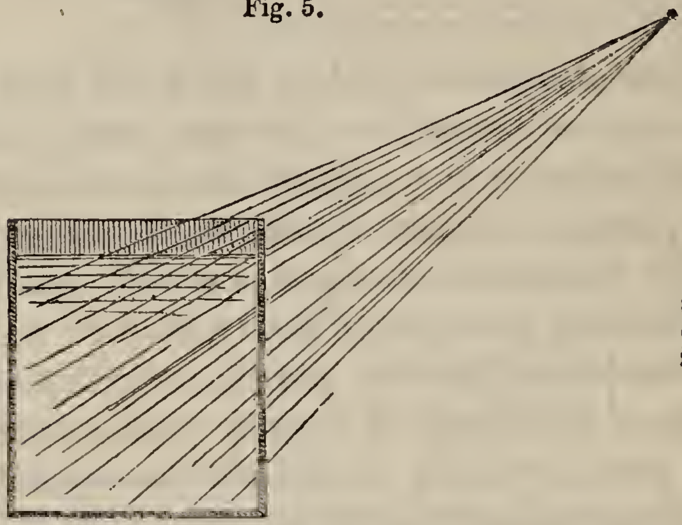
* The cement formerly employed, and still used elsewhere, becomes decomposed and friable in a few months.

First, in point of general excellence, are Tanks with the back sloping downwards from the source of illumination. This arrangement not only enables objects to be seen in a slanting light so as to exhibit their form and colour to the greatest advantage; but also—(and this is their great merit)—causes the light and its incidental heat to penetrate the water *at its surface.* The effect is, that a greater amount of coolness is obtained in this manner, than in forms of Tanks where the light and heat of the sun enter the water *laterally, and therefore wrongly, thus*:—*

Fig. 5.



This engraving shows the old and erroneous mode of illumination.

The shelving back also enables animals to choose for themselves any depth suiting them, and they very generally avail themselves of this accommodation. Tanks of this kind are divided into two kinds, each, however, being subject to some modification to suit minor considerations.

The following is a description of the whole series of Tanks:—

1st. Slope-back Tanks† in which the triangular space under the slope (or oblique partition or diaphragm) is converted into a "dark water-chamber," the fluid in which freely communicates, by holes, and by other means, with the corresponding illuminated portion in front, as shewn in this section:—

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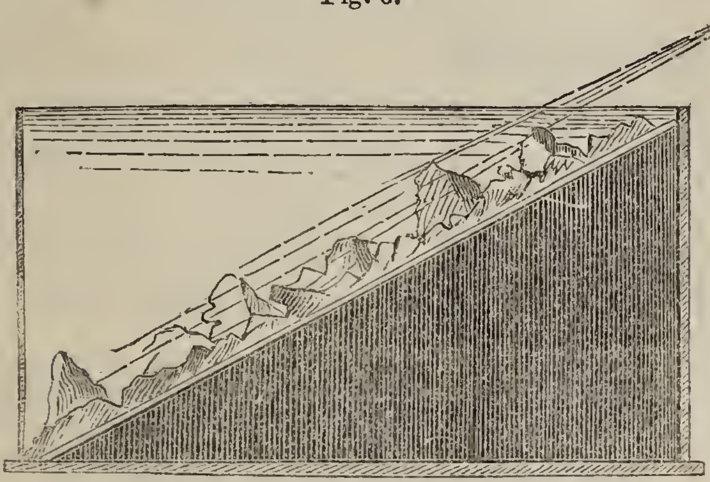
* In figures 5, 6, 7, 9, and 14, the representation of the refraction (or bending) of rays of light entering water obliquely, is omitted for the sake of simplicity.

† Mr. Gosse, in two of his books ("The Aquarium," and "A Handbook to the Marine Aquarium") mentions the sloping-back Tank in terms of disapproval. Fortunately,

Fig. 6.*



See also pages 60 to 65, figs. 16 to 21. The animals do not obtain admission into the dark portion, though the water in it is made available for them without any increase of the area of the Tank, and thus the effect is to give a large volume of fluid with no waste of the space which the construction of this form of Tank would otherwise occasion. The dark chamber also effectually counteracts a tendency which exists, in spring and summer, on the part of that property in light known as "Actinism," to cause the water (especially sea-water) to become of a greenish-brown and densely opaque colour. If a remedy for this evil be sought in making one of the sides of an ordinary tank of a non-transparent material, too much light will be excluded, and the illumination of the

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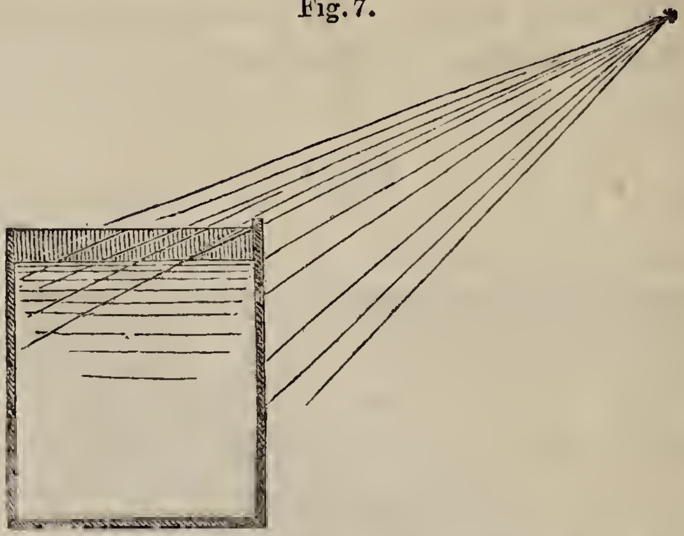
however, he gives the exact shape and proportions of the particular tank under his eye, *but*, the form and proportions he names, wholly alter the principles and the action of the vessel as now perfected. Apart from the science of the matter, however, Mr. Gosse speaks of his Aquarium as being in appearance, externally, "lumbering and inelegant," and internally, as of "uninviting gloominess." But certainly these expressions are very far from being applicable to the Tanks at present made. The five years which have elapsed since the date of this gentleman's observations, have so entirely modified Aquarium science, that the opinions which were orthodox in 1853, are obsolete in 1858.

* As this a section from back to front, no rude arches are shewn as in fig. 11, page 52, though such arrangements can be made with equal facility in either Tank.

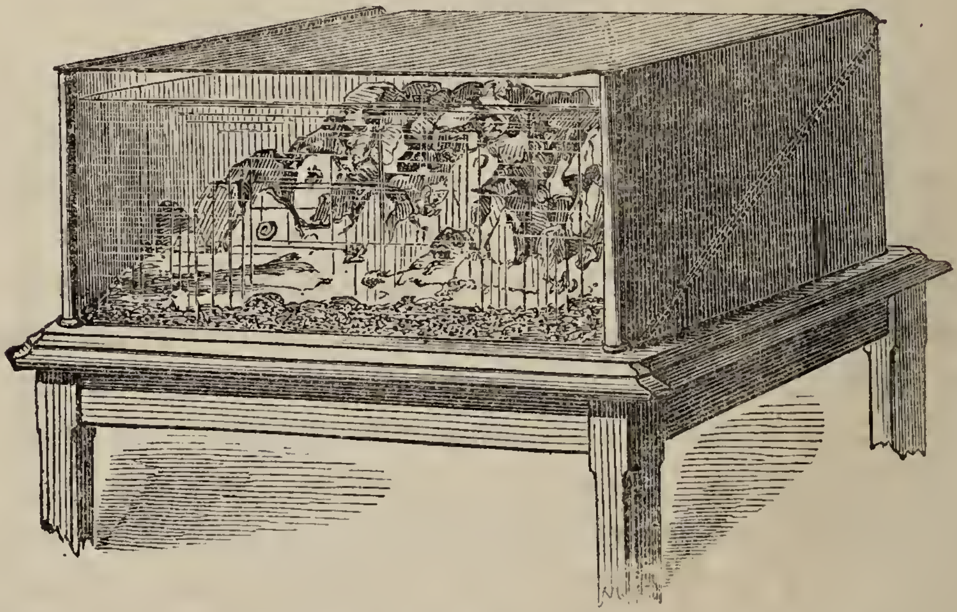
portion intended to be seen will be but partial and ineffectual, thus :—

Fig. 7.



A perspective view of a dark-chambered slope-back Tank is here shewn :—

Fig. 8.*



While this Aquarium remains in good condition, the advantages are those of *passive* contact between the water in the front and in the behind-chamber. If, however, the water in the front chamber should become slightly foul, it and the pure water in the hinder chamber may be made to exchange places *actively* by a small pump, through an orifice left for that purpose. If also, by excess of light, the water should become green, a similar interchange may be made, and, as the hinder partition contains no organic matter, and has no light admitted to it, any water placed there rapidly becomes deodorised and colourless.

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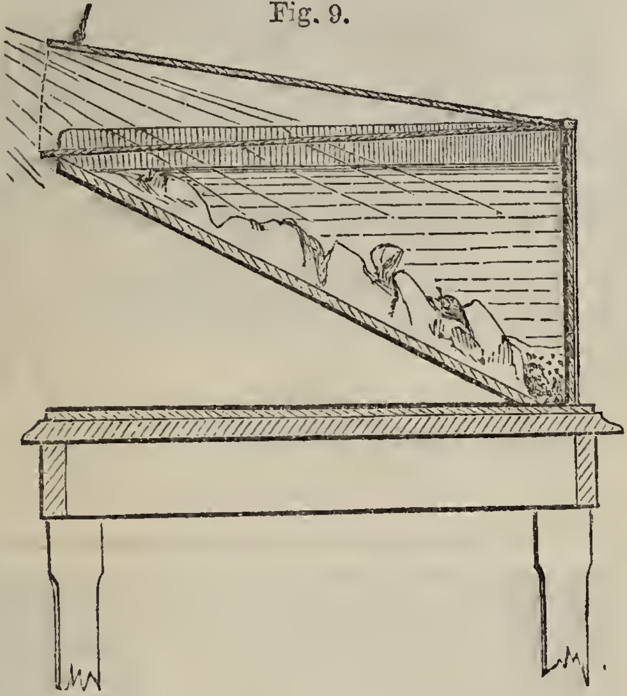
* The effect given here is not so good as it should be, as the artist neglected to represent the rock-work cemented to the side-wall of the Tank.

This compensating principle of a dark chamber is one of the most important yet introduced in connection with Aquaria, and it, and every modification of it, is secured by patent.

2nd. Slope-back Tanks in which the triangular space below the back is not provided with a dark water-chamber, but the back is supported by slate brackets of varying pattern. See pages 66 to 69, figs. 22 to 25, The brackets are necessarily not shewn in this section:—

Fig. 9.

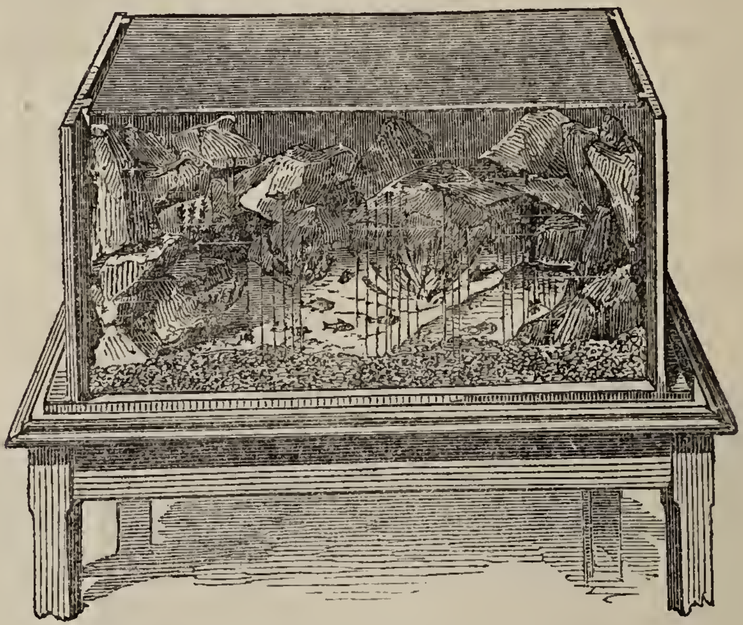


which is introduced to exhibit the mode of interior arrangement and the admission of the light, but it will be seen that the cover is rendered more or less opaque, and is partially lifted up and supported, so as in some measure to fulfil the effects on light which in the first named Tank is performed by the dark chamber.

Tanks on this principle are not as effective as those with a dark chamber, and the number of animals have to be lessened in proportion to the diminished bulk of water, and the choice of aspect has also to be regulated accordingly. Externally, the difference in appearance is shewn on comparison of the various figures in pages 60 to 69.

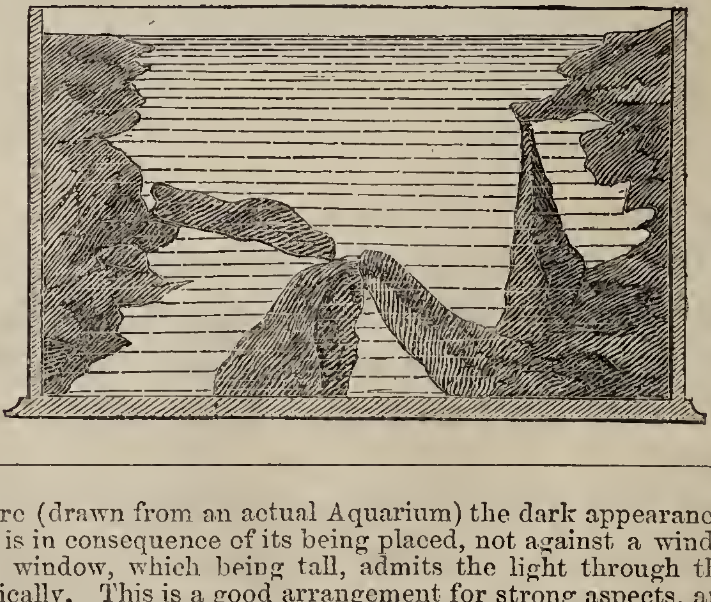
3rd. Tanks having the same general outline as the first described, but made narrower, with glass at the back and front, and with slate ends, and upon and against the latter the rockwork is built and attached by cement, as shewn in this perspective view :—

Fig. 10.*



and in this somewhat varied section :—

Fig. 11.



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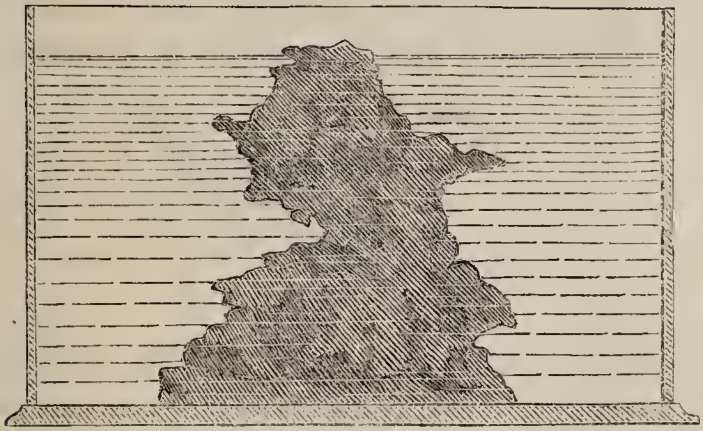
* In this figure (drawn from an actual Aquarium) the dark appearance of the further side of the Tank is in consequence of its being placed, not against a window, but against a wall *under* the window, which being tall, admits the light through the cover of the Tank nearly vertically. This is a good arrangement for strong aspects, and when no wall or other natural screen exists, the side next the window should be covered with blue tissue paper, variously adjusted according to the season.—See page 108.

Such a Tank, so built up inside, is not only very effective in appearance, but answers well for most situations having a north or a north-east aspect, so as to avoid the afternoon sun in hot weather, and it is excellent under the circumstances of fig. 10. It is obvious that the rock-work may be built so as to afford a very great amount of shade and of picturesque appearance.

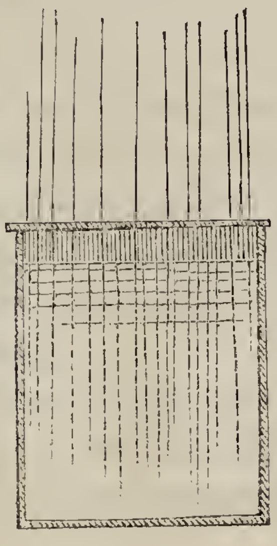
4th. Tanks of the same shape as the last named, but having the two ends as well as the two sides of glass. No rock-work can safely be made to rest against the glass, and thus it must be piled-up in the centre, as in the following sectional view :—

Fig. 12.



Such vessels are far less useful than either of the kinds previously described, and indeed they are adapted only for some exceptional situations, such, for example, as where there is but a very moderate amount of perpendicular illumination from a sky-light, thus :—

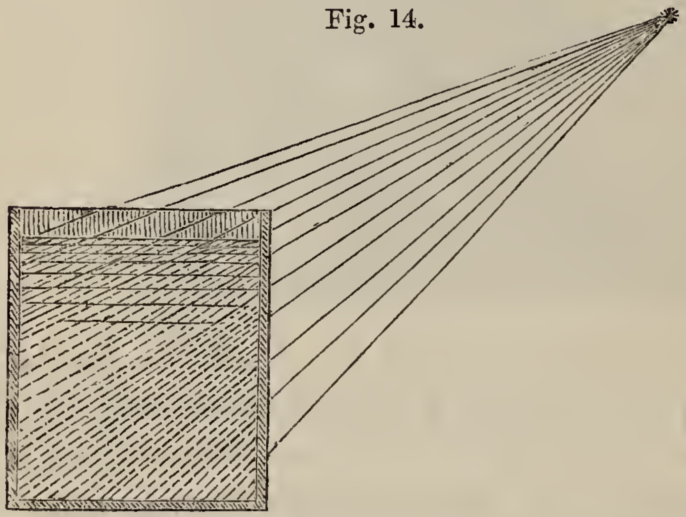
Fig. 13.



or in positions which allow of only a very dim diffused light, which is desirable to be made available from every side; or else in aspects facing due north, with no incidental light from any other quarter. Even in such instances, the rock-work cannot so easily be made effective as in other styles, and continual vigilance has to be exercised in the regulations of heat in summer and of light at all seasons.

It has been frequently recommended that the excessive transparency of tanks, such as those being now described, should be met by the employment of coloured glass, or of curtains, or of various semi-transparent media, on the side next the source of light. Such arrangements, however, are unsatisfactory, and moreover, the interior of the Aquarium is unnaturally coloured thus:—

Fig. 14.



The darkly-shaded lines within the Tank in this engraving, are intended to represent coloured light.

whereas the object in view should be to obtain by simple means a properly cool, but *natural* illumination. And this can best be attained in the construction of the Tank itself, instead of first adopting a wrong form and then inventing a remedy.

5th and lastly, Tanks with six and with eight sides, all of glass. The same remarks and the same sections applied to vessels having four glass sides, apply also to hexagonal and to octagonal aquaria, but with greater force.

In this manner, each form of Aquarium has its own advantages or otherwise, to suit certain circumstances as they are found to exist in dwelling-houses, such circumstances having reference to light and to aspect as affecting heat.

The following is a summary ot the principles concerned in the regulation of light and heat:—

I. The object to be attained is the healthy growth and permanent maintenance of certain living plants and animals in unchanged water, and under conditions ascertained to be natural.

II. This is done chiefly by the growth of plants in a certain manner.

III. It is desirable to obtain not only the growth of plants, but also that each kind of vegetation shall have its *characteristic* appearance and colour.

IV. This is effected by a proper management of *light and heat.*

V. The tendency of light and heat, admitted in a wrong direction, or in too great quantity, is to cause an *excessive* growth of minute vegetation, tending to obliterate the characteristics of the other plants, and to cause the water to become turbid and green.

VI. The admission of light freely and directly through the two opposite sides or ends of a Tank of whatever shape—whether flat-sided or other—is an instance of the excessive employment of light, and is contrary to right principles, inasmuch that in nature the light required and obtained by aquatic organisms is very small in amount, and is obtained *always through the surface* of the water.

VII. It is quite possible, on the other hand, to have too little light, and this also is productive of evil. What is wanted is, *not darkness*, but *light modified.*

VIII. The range of temperature in the ocean or in a river is not greater than from about 45° to 65° of Fahrenheit's thermometer. In the atmosphere of England, the range is from about 20° to 90°. Therefore an endeavour should be made to approximate to the first-named range, by the choice of aspect, and by other obvious methods.

IX. According to these principles, the most desirable arrangement in Tank constructions is that in which the glass in the side or sides of the vessel is for the *observation* of the contents only, but not for *illumination*—the light coming in at the top alone. The effect thus produced is the right one, *i. e.* the objects are looked *at*, not *through*.

X. A slope-back Tank with dark water chamber, placed in a position ascertained to be the coolest in summer, and capable of being warmed moderately in winter, is the Tank which permits all these points to be perfectly carried out.

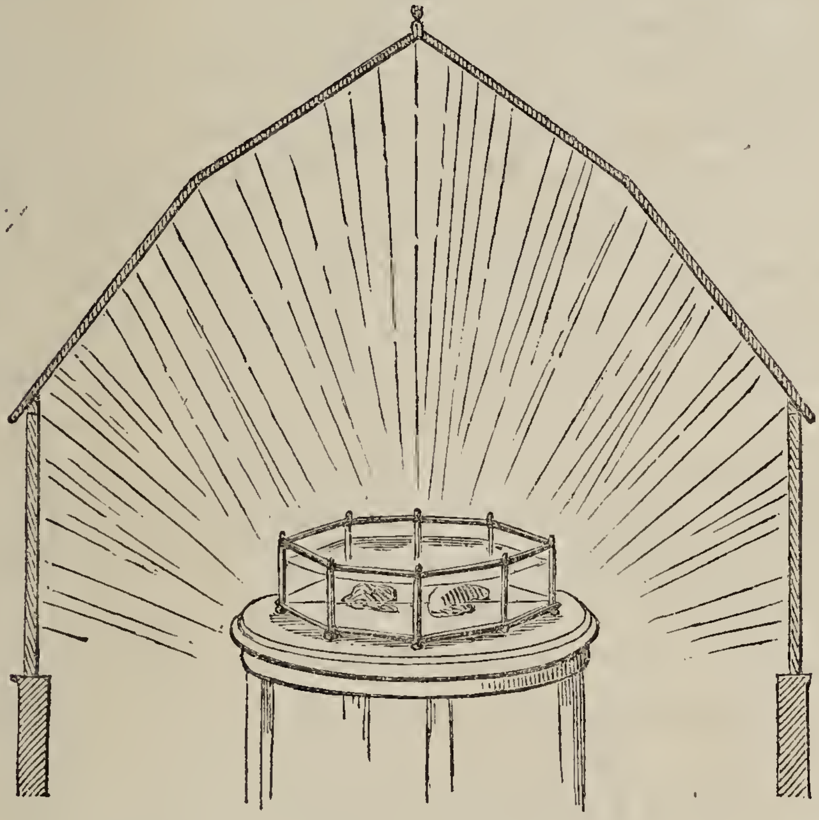
But, independently of these considerations, it is desirable always to make choice of a Tank which contains the least amount of so brittle a material as glass, as it is obvious that the risk of breakage is diminished to the extent of eighty or a hundred per cent. in a vessel with only one piece of glass in it, compared to one which has from four to eight squares.

Finally, this greater employment of opaque surfaces offers larger facilities than have been hitherto given for the introduction of ornamental features, all decoration, however, being rendered subservient to the constructive portions. Thus, knobs, finials, trellis-work, feet, and other useless additions are rejected, and parts only essential for actual construction are retained. Most of the Tanks are finished in two modes, one ornamental, and one quite plain. But, while the respective costs vary on this account, the materials and the solidity of make are precisely equal in both. *These Tanks are what no other Tanks are, or ever have been: they are handsome and substantial pieces of furniture, in every way fitted for admission into the drawing-room or dining-room, and at the same time they adequately fulfil all the scientific requirements demanded: moreover, even reckoning bulk for bulk, they are as cheap as any yet made.*

They can be constructed of any size or proportions to suit spaces—the largest continuous one yet built, being thirty-four feet long. There is no limit to the strength of the materials employed, and large Aquaria are proportionably less in price, and the chances of success, and the amount of variety of objects which can be kept in them, are greater than in small Tanks, the latter being intended for small objects only.

It has been frequently and popularly recommended that Aquaria should be placed in *Conservatories*,* but nothing can be more inappropriate than such situations, especially in the spring and summer time, because the conditions sought in the erection of such buildings, or of Green-houses, Hot-houses, Fern-houses, or other arrangements of a similar nature, are utterly at variance with the principles involved in the successful maintenance of Aquaria. A sectional representation of a commonly occuring and not extreme case of error of this nature, is here shewn:—

Fig. 15.



and the water under such circumstances would remain clear for not longer than one summer's day, in consequence of the great amount of heat and light incidental to, and necessary for, the legitimate purposes of a building of this nature.*

---

* "For a Conservatory, to which an Aquarium would form an appropriate accessory a vase-like form might be given to a large Tank. If the outline were octagonal, the objects in the interior would be visible through the plate-glass without the distortion caused by unequal refraction, which is a great objection to vessels with curvilinear sides."—GOSSE'S "HANDBOOK," page 8.

The observation about distortion is correct, but hardly any suggestion can possibly be worse than that here offered respecting the situation of a Tank, whether it be eight or four-sided, or circular, or of any other shape whatever. As an almost invariable rule, any building, of any aspect, devised for the reception of plants, and into the construction of which glass largely enters, is totally unfit for Aquarium purposes during at least nine months of an English year. Certainly, the Aquarium is one of the very few things not greatly benefitted by the reduction of revenue duties on glass!

Arrangements have been at various times put forward for combining the growth and maintenance, in the same case or vessel, of plants and animals which are semi-aquatic during a portion or the whole of their lives, or of animals alone which live in water in their early stages, and afterwards exist in air. Without here entering minutely into the technical reasons existing against the success of such contrivances, it may be stated that the difficulty is extreme in keeping up the several sets of balances necessary for health under such circumstances, except in a very few instances, and the apparatus necessary for these exceptions can be cheaply and gracefully applied to any of the Tanks in this list. For while it is easy to feed and to maintain Butterflies and Moths in their Caterpillar state, and while the aquatic Larvæ and Pupæ of Dragon-flies, May-flies, Day-flies, and some others, can be kept in Tanks without difficulty, yet, when these insects attain their final or winged state, they are the most inappropriate creatures possible for any glass case of a size which can be placed in a room. Their rapidity of flight through the air; their impatience of confinement; the difficulty and uncertainty of procuring proper food, and the perishable nature of such food; and their well-known short period of existence—usually terminated with the first deposit of eggs—all contrast most unfavourably with the substantial and permanent character of the arrangements of regular Aquaria. Combinations of this kind should never be attempted without a very full knowledge of the habits, under every contingency, of the organisms to be dealt with.

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* A room on the first floor of a house in a densely populated part of London, closely surrounded by high buildings, with one window facing due east, glazed with ground glass, and having its aperture of an area equalling only one-twelfth of the area of the four walls of the apartment, is found to yield ample light enough for several flourishing Aquaria. The same result is attained in another room, with a due west window, glazed with fluted glass, of an area of only one-twentieth of that of the walls. These are actual instances, cited in opposition to the Conservatory notion.

A TABLE OF CHANCES.

An attempt to express by figures, and in the form of a Table, the various results which may be expected from the combination of certain forms of Tanks, with certain aspects, positions, or places; the figure "20" being used as an ideal equivalent for the most perfect success, and the figures "·00001" as representing the greatest non-success. This table, however, must not be accepted as an absolute expression of all *possible* variations of circumstances, but it may, by the exercise of judgment, and by supposing all other things to be equal, be relied upon as a general guide, based on calculations carefully worked out from a long series of observations made every month during a period of about six years, reference being had to *permanence*, clearness of water, and general good condition in hot weather.

Numbers and Kinds of Tanks.	Top Lights.		Side Lights in Ordinary Dwelling Rooms.									Other Conditions.	
	Under-ground.	Skylight and no side light.	Facing the North.	Facing the North-East.	Facing the North-West.	Facing the East.	Facing the West.	Facing the South-East.	Facing the South-West.	Facing the South.	Crosslights being combinations of S. or S.W.	Conservatories and other similar buildings.	Out of Doors, Sheltered or not.
1 to 12 page 60 to 69.	19	18	18	19	17	19	14	13	12	10	8	1	1
13 to 15	19	18	18	19	17	19	13	12	11	9	7	·01	·01
16 to 18	19	18	18	19	17	15	12	11	10	8	6	·01	·01
19 to 21	19	18	18	17	15	14	10	9	8	6	4	·001	·001
22 to 33, p. 70 to 73.	19	17	17	15	12	12	8	7	6	4	1	·001	·001
34 to 36, p. 74 & 75.	19	15	15	10	8	8	3	2	1	·01	·001	·0001	·0001
37 and 38, p. 76 & 77.	19	8	8	4	3	2	1	·1	·01	·001	·001	·0001	·0001
39 and 40, p. 78 & 79.	19	8	8	4	3	2	1	·1	·01	·001	·0001	·0001	·0001
All Glass, p. 90 to 94.	19	6	6	3	2	1	1	·01	·001	·001	·0001	·00001	·00001
All Opaque, p. 92, fig. 47.	19	19	19	18	17	17	15	14	13	9	6	2	1

From the above Table, the following deductions are to be made:—

1.—When the requisite conditions of low temperature and proper amount and direction of light are complied with to the fullest extent, as in a cool underground apartment, with a skylight or an acutely slanting side-light, the kind of vessel is of but little consequence.

2.—In proportion to the extent of decrease of right conditions, care must be exercised in selecting the kind of Tank.

3.—The vessel best adapted for Aquarium purposes is one with all the sides opaque, and with an amount of depth corresponding to the angle at which the light is admitted, but, as such a vessel would be unsightly, and as the view of the contents would be very imperfect, the sloping-back Tank is devised and this is merely an opaque vessel with one side of glass.

The Tanks and the observations appended to each kind respecting fitness, are nearly equally applicable to both Marine and Fresh-water purposes.

In ordering, it is only necessary to quote the Number, printed in a heavier type in the left-hand column.

The Prices are for the Tanks empty, as represented, with a Glass Cover.

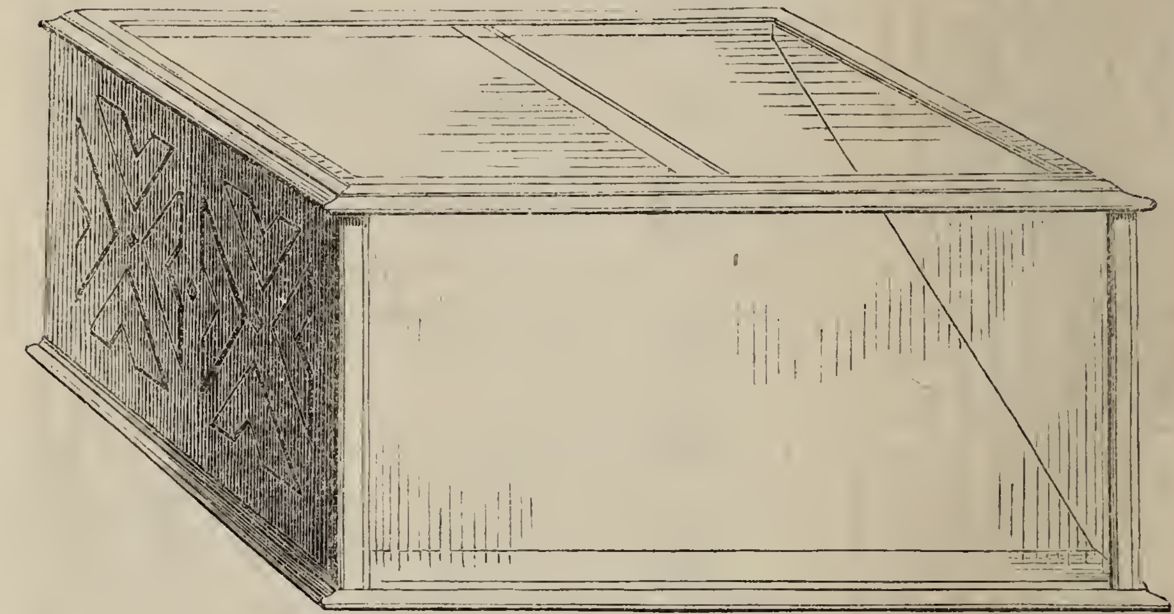
It is not always possible to adhere strictly to the sizes given, on account of the varying width and style of the flange or border. This may vary to the extent of three inches. The ornamentation and the style generally will not necessarily be adhered to as to actual pattern. If so, there would be no margin left for improvements.

SLOPE-BACK TANKS (PATENT).

With Dark Water-Chamber, Opaque Ends, Transparent Front, and Transparent Top.

Finished with Carving, Moulding, and Gilding, painted in one, two, or more colours and varnished, or varnished without paint.

Fig. 16.



No.	Outside Size in Inches (about).			Capacity in Gallons (about).	Price.		
	Length.	Breadth.	Height.		£	s.	d.
1.*	72	41	22	156	20	0	0
2.	48	39	21	93	18	0	0
3.	36	39	18	60	11	0	0
4.	30	33	15	33	7	10	0
5.	24	27	13	20	5	15	0
6.	20	26	~~14~~/2	10	4	5	0

The above-named are suited for positions where the light is admitted strongly, both by front and by side windows, the effect being to convert lateral into oblique light. The ornaments and style of finish can be varied infinitely. Suitable for drawing-rooms, and other similar situations. See fig. 6, page 49, and fig. 8, page 50.

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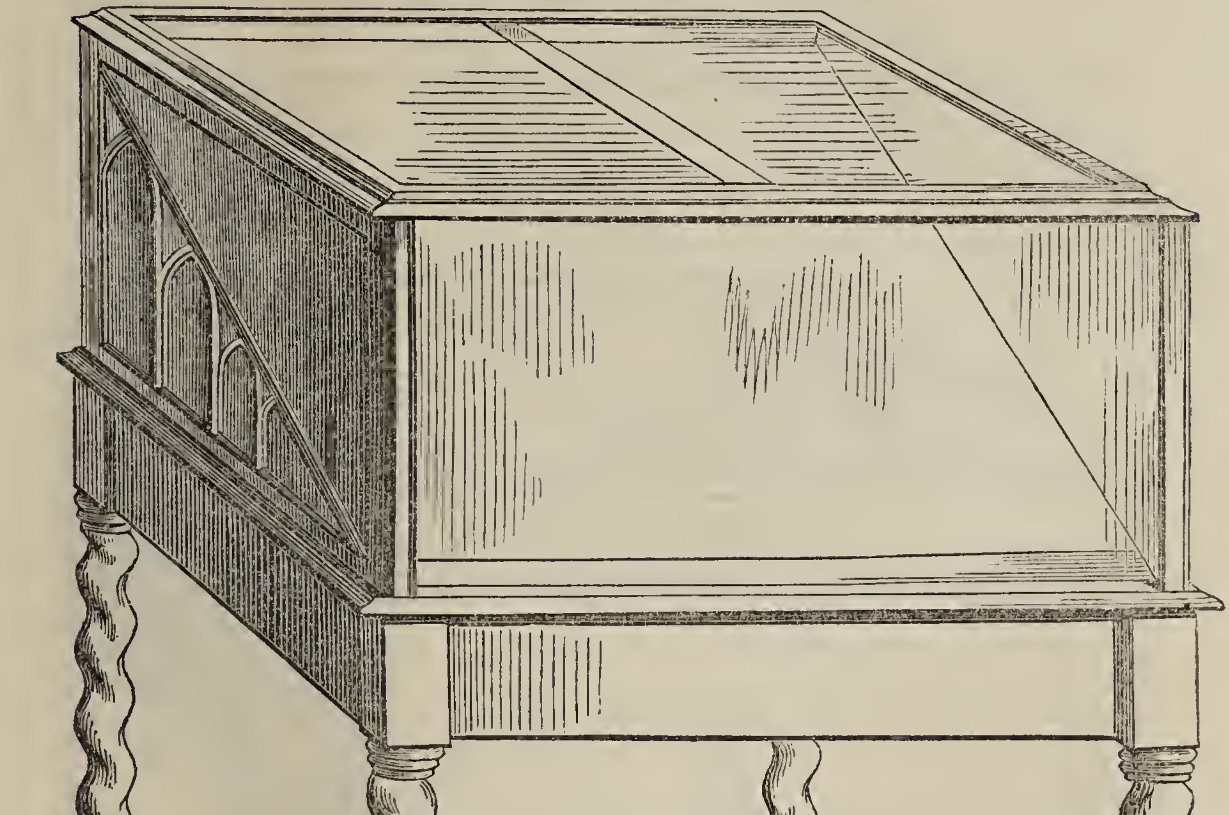
* Tanks Nos. 1, 2, 7, 8, 22 and 28, are too large be to sent out in a built-up state, and they must be erected on or near the spot they are intended to occupy. In London this is done without extra charge, but when the distance from town involves travelling expenses and lodgings for workmen, such costs are added to the prices given.

Fig. 17.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

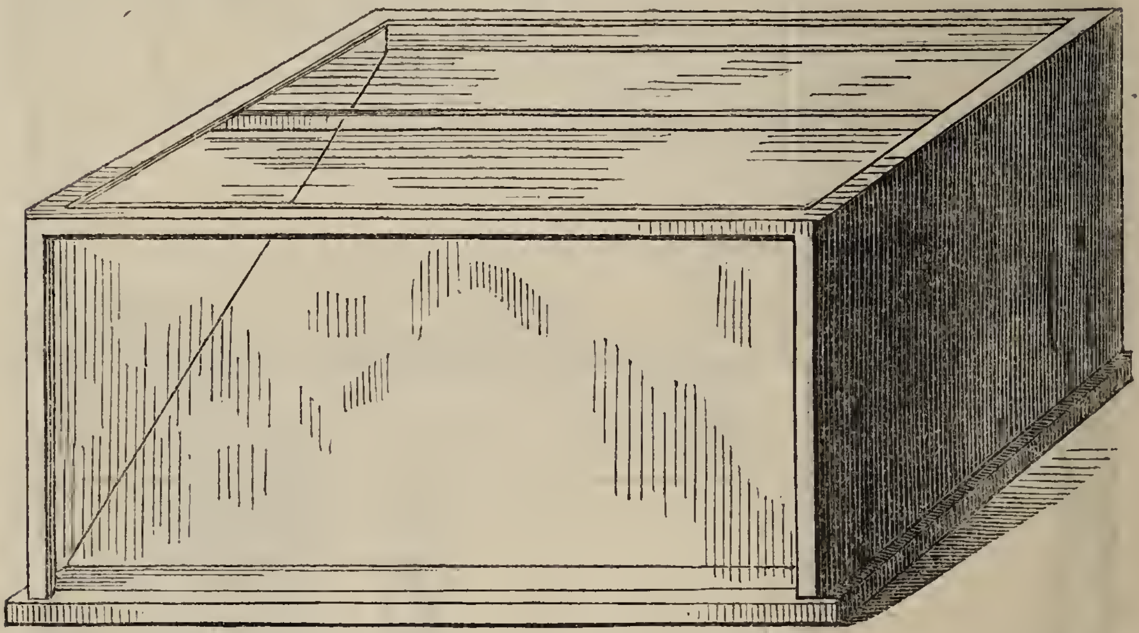
See section fig. 6. page 49, and fig. 8, page 50.

SLOPE-BACK TANKS (PATENT).

With Dark Water-Chamber, Opaque Ends, Transparent Front, and Transparent Top.

Finished Plain, with rounded or bevelled edges, painted in one colour, and varnished, or varnished without paint.

Fig. 18.



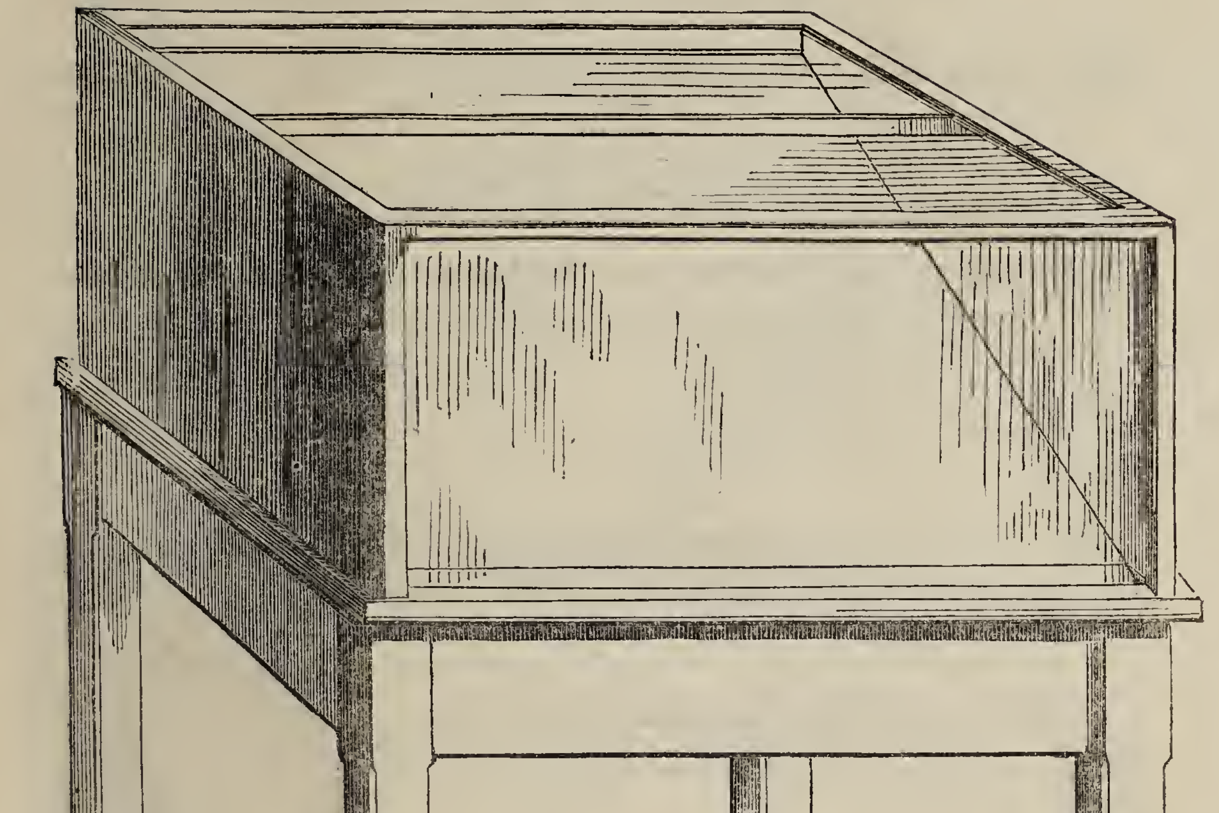
No.	Outside Size in Inches (about).			Capacity in Gallons (about).	Price.		
	Length.	Breadth.	Height.		£	s.	d.
7	72	41	22	156	18	0	0
8	48	39	21	93	15	0	0
9	36	39	18	60	8	10	0
10	30	33	15	33	6	15	0
11	24	27	13	20	4	15	0
12	20	26	~~14~~ /12	10	3	5	0

Suited for places having strong lights. Same as preceding Tanks, but plainer.

These are well adapted wherever a thoroughly strong, neat, and effective Aquarium is required, and for all general purposes, whether Marine or Fresh-water, nothing better can be chosen. In appearance they are admissible for studies, dining-rooms, breakfast-parlours, or halls, if the other essentials are complied with.

See section fig. 6, page 49, and fig. 8, page 50.

Fig. 19.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

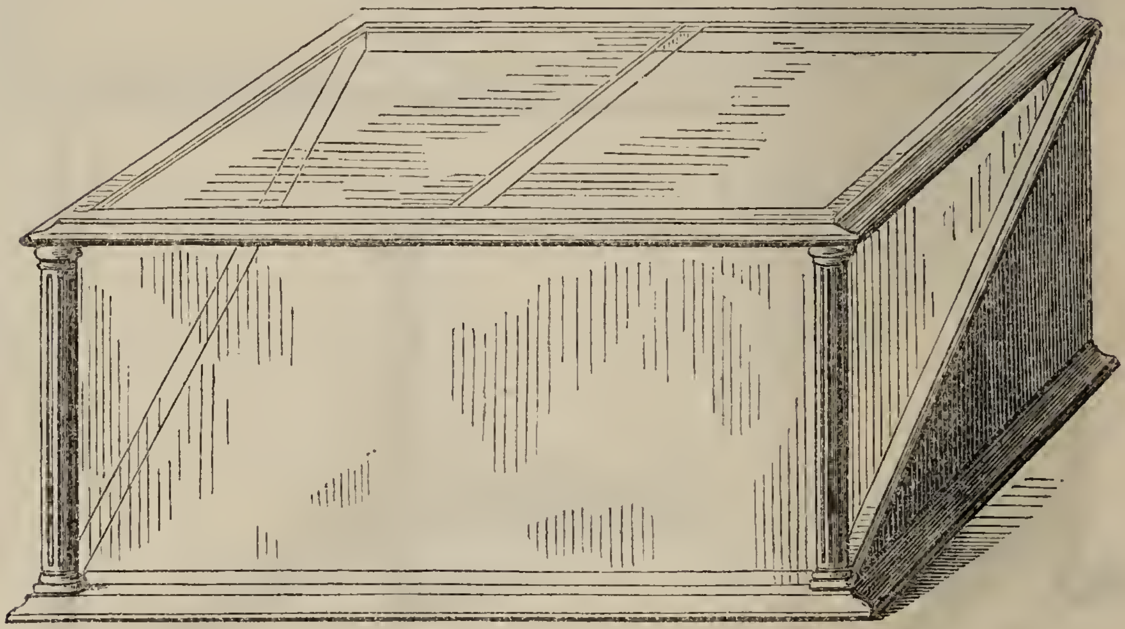
See section fig. 6. page 49, and fig. 8, page 50.

SLOPE-BACK TANKS (PATENT).

With Dark Water-Chamber, Transparent Ends, Transparent Front, and Transparent Top.

Finished with Carving, Moulding, and Gilding, painted in one, two, or more colours, and varnished, or varnished without paint.

Fig. 20.



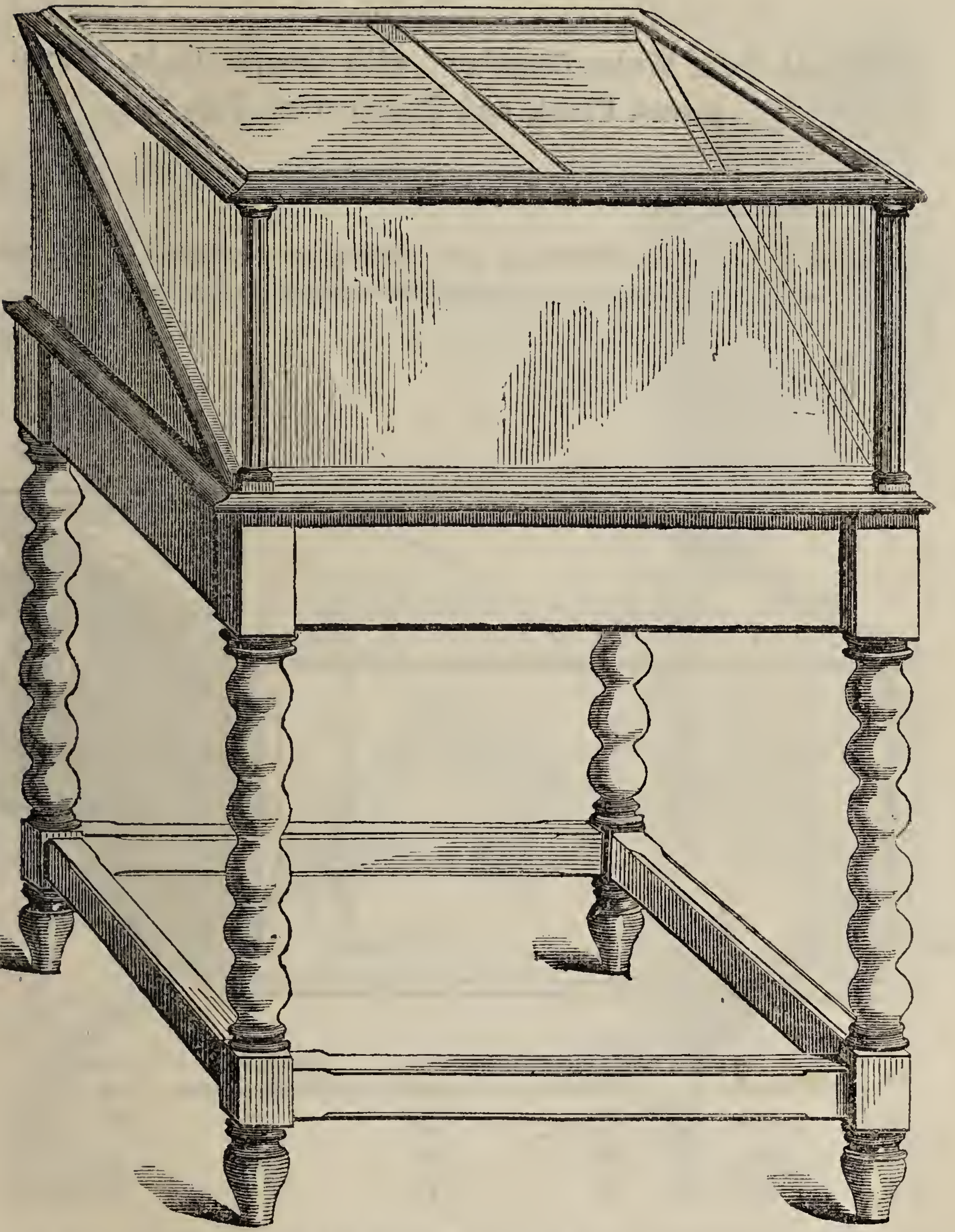
No.	Outside Size in Inches (about).			Capacity in gallons (about).	Price.		
	Length.	Breadth.	Height.		£	s.	d.
13	36	39	18	60	12	0	0
14	30	33	15	32	8	15	0
15	24	27	13	20	6	0	0

Adapted for situations with not much, or no side light.

These are made only in the above three sizes, and are finished in one style. The sides of the dark chamber can be ornamented. No rock-work against the glass sides.

See section fig. 6, page 49, and fig. 8, page 50.

Fig. 21.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

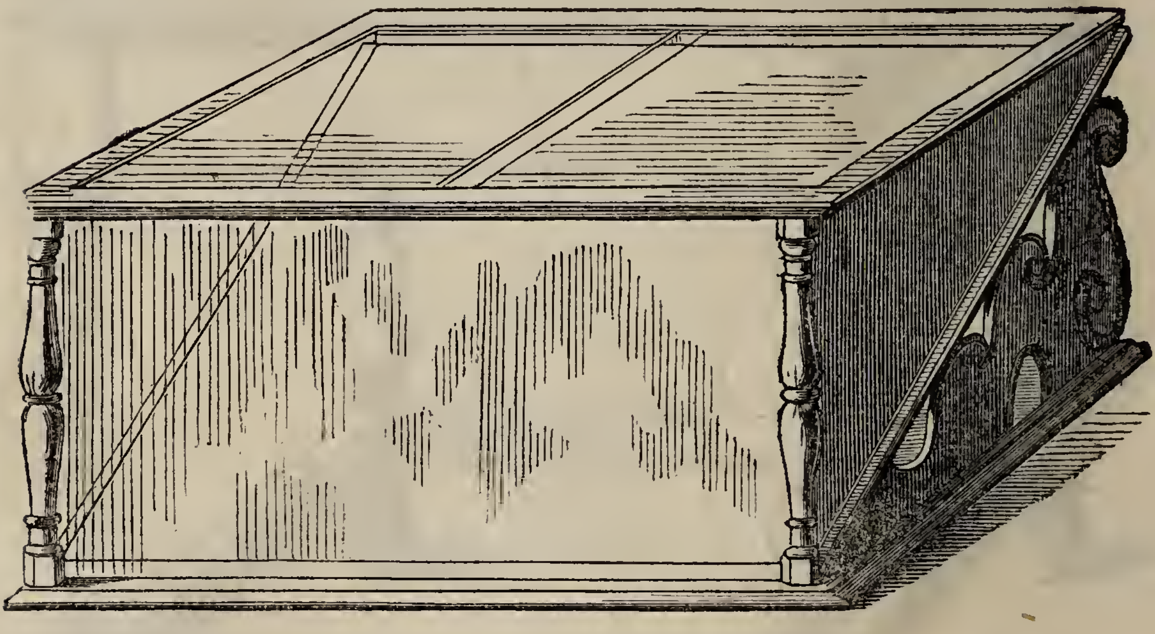
See section fig. 6, page 49, and fig. 8, page 50.

SLOPE-BACK TANKS.

Without Dark Water-Chamber; with Opaque Ends, Transparent Front, and Transparent Top.

Finished with Carving, Moulding, and Gilding, and painted in one, two or more colours, and varnished, or varnished without paint.

Fig. 22.



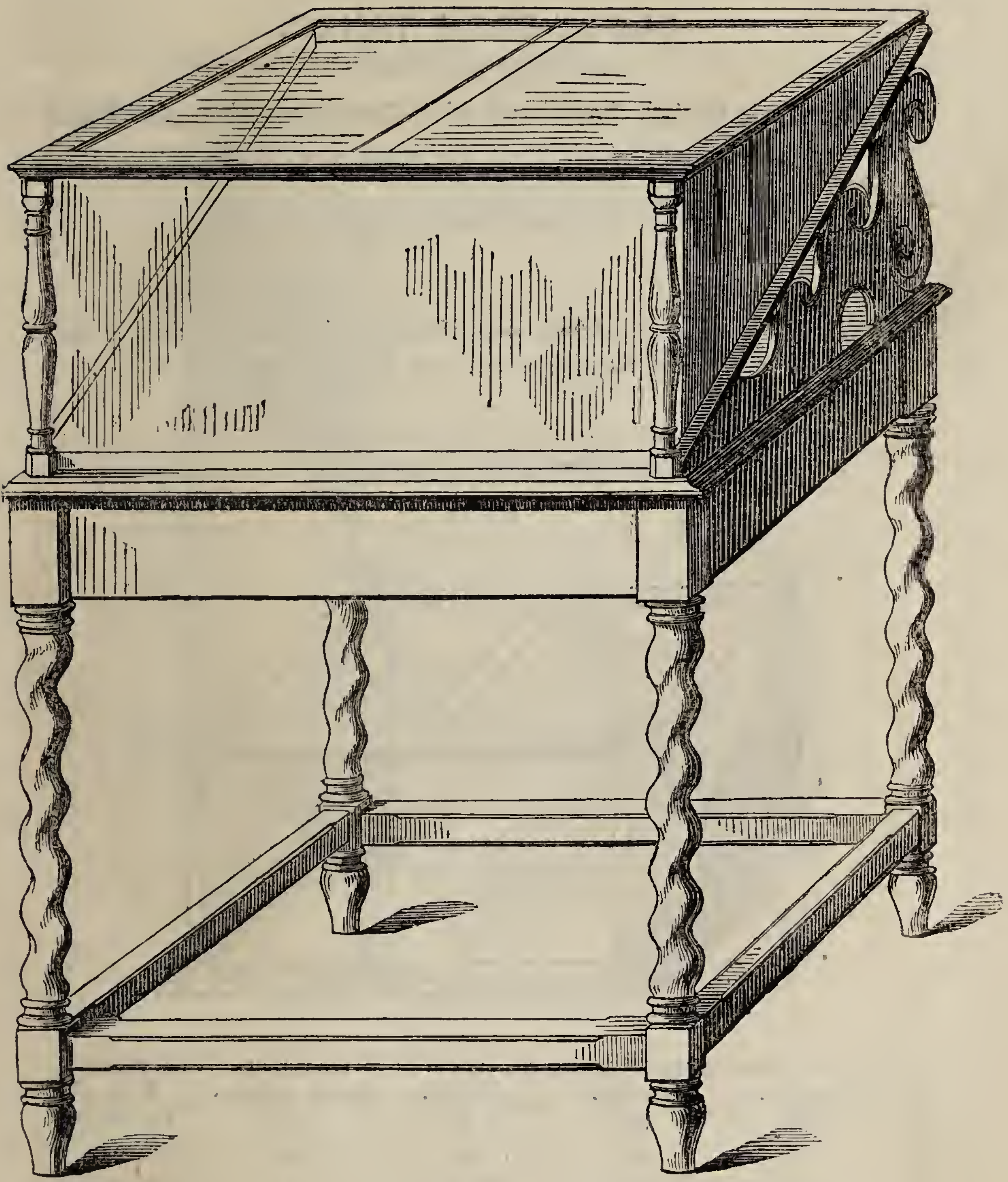
No.	Outside Size in Inches (about). Length.	Breadth.	Height.	Capacity in Gallons (about).	Price. £	s.	d.
16	36	39	18	28	10	0	0
17	30	33	15	15	8	0	0
18	24	27	13	7	5	15	0

Same remarks as at pages 60 and 62, but less water is here used.

Blank spaces at sides may be ornamented. Not made in other than the three sizes named, and not finished plainer.

See section fig. 9, page 51.

Fig. 23.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

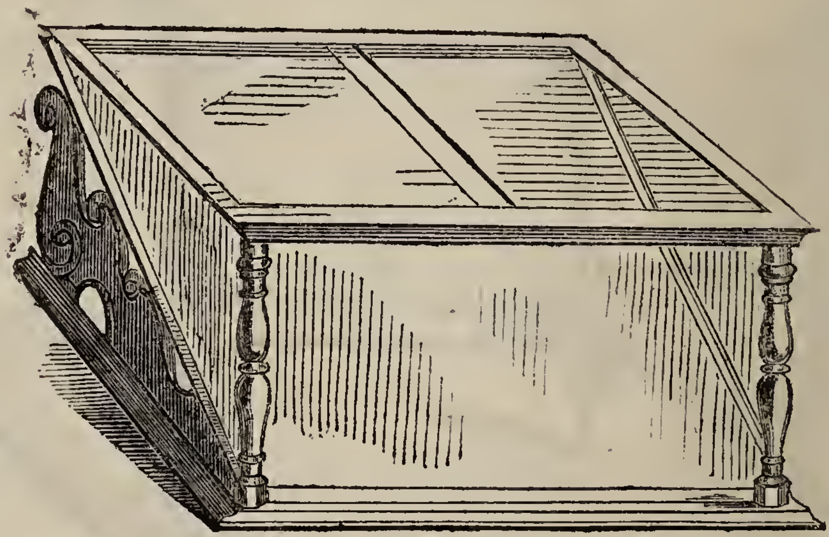
See section fig. 9, page 51.

SLOPE-BACK TANKS.

Without Dark Water-Chamber; with Transparent Ends, Transparent Front, and Transparent Top.

Finished with Carving, Moulding, and Gilding, painted in one, two, or more colours, and varnished, or varnished without paint.

Fig. 24.



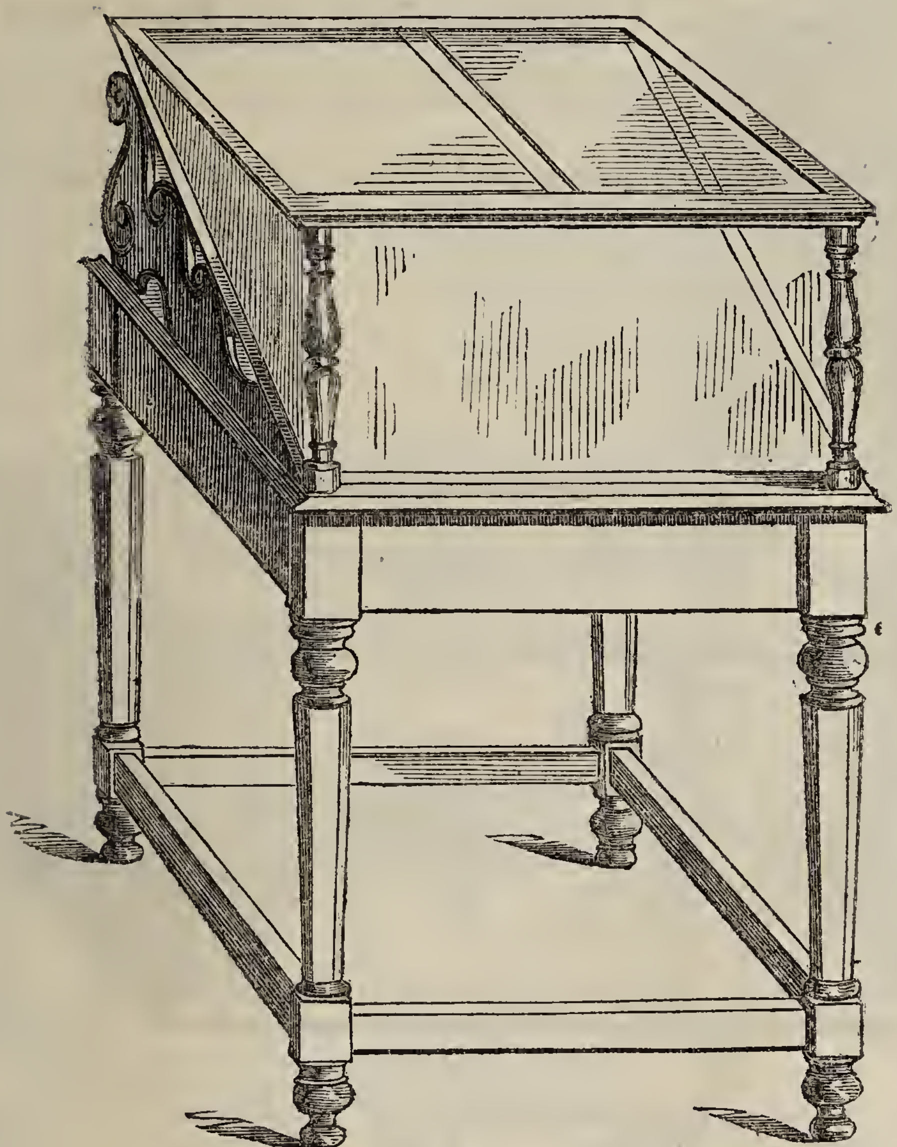
No.	Outside Size in Inches (about). Length.	Breadth.	Height.	Capacity in Gallons (about).	Price. £	s.	d.
19	36	39	18	28	10	0	0
20	30	33	15	15	8	0	0
21	24	27	13	7	5	15	0

Same observations as at page 64, but with less water.

No rock-work against the glass.

See fig. 9, page 51.

Fig. 25.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

See section fig. 9, page 51.

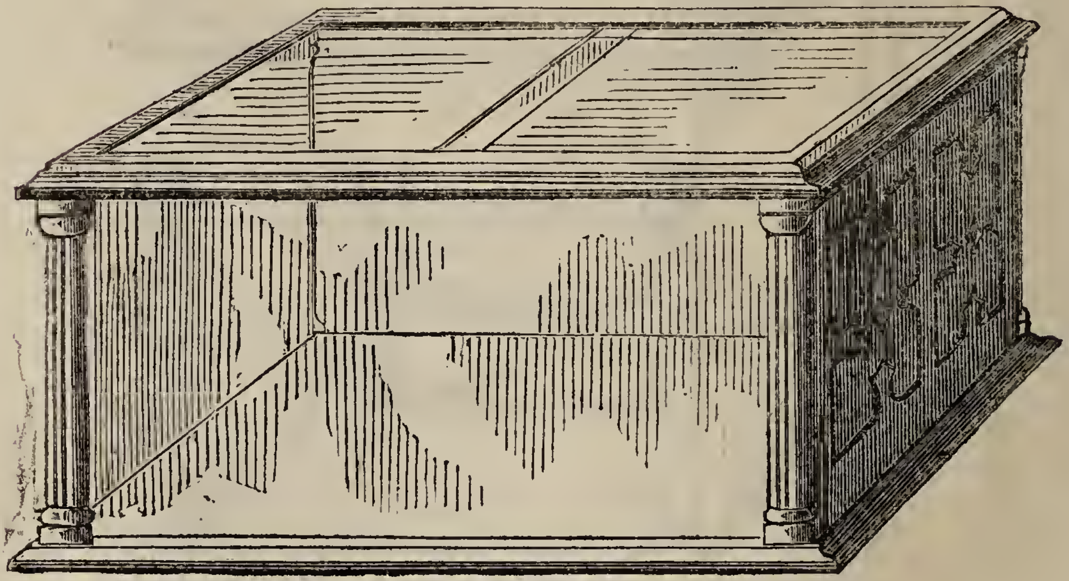
This Tank, mounted as above represented, is very elegant and light in appearance, and effective in action.

RECTANGULAR TANKS.

With Opaque Ends, Transparent Sides, and Transparent Top.

Finished with Carving, Moulding, and Gilding, painted in one, two, or more colours, and varnished, or varnished without paint.

Fig. 26.

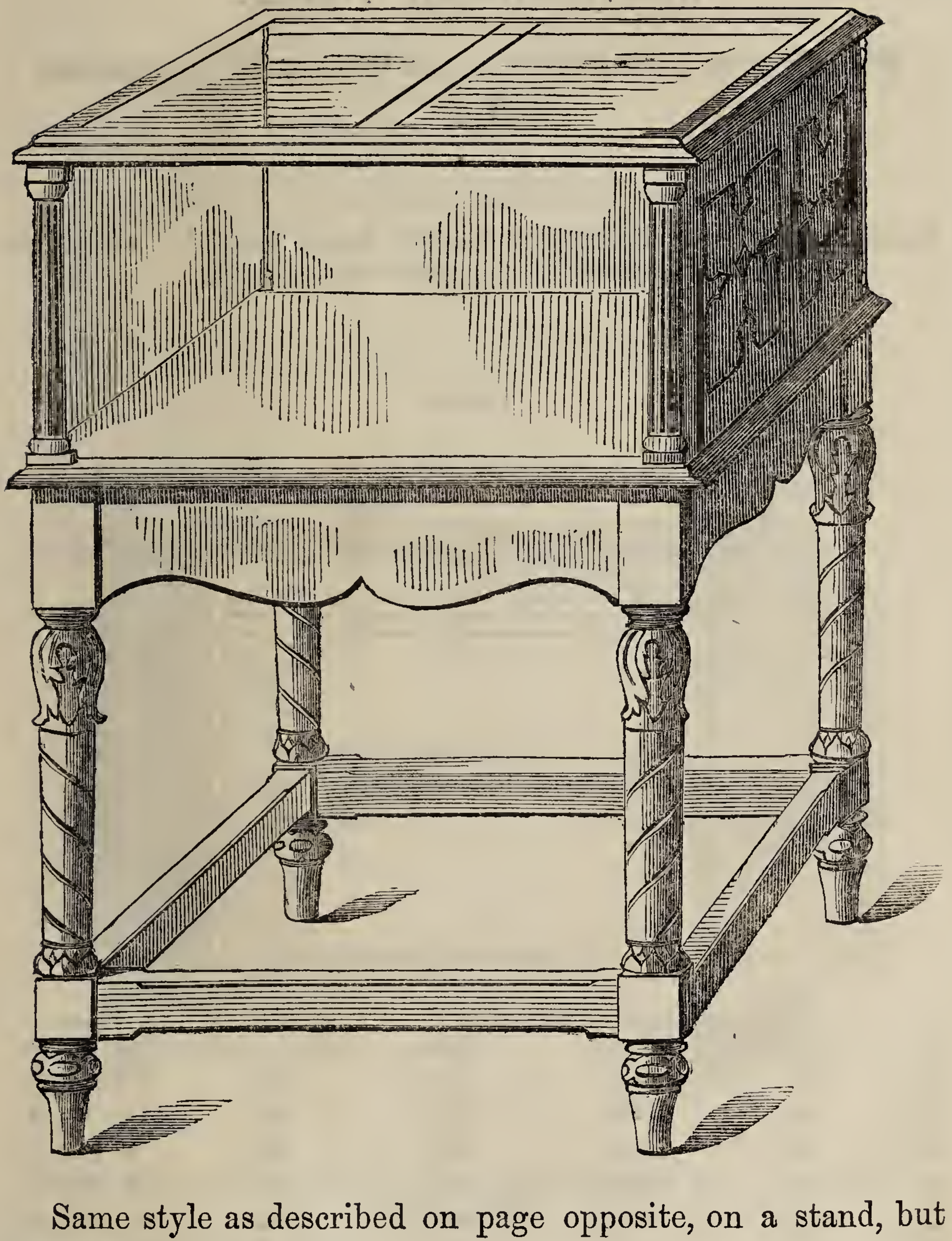


No.	Outside Size in Inches (about). Length.	Breadth.	Height.	Capacity in Gallons (about).	Price. £	s.	d.
22	72	28	22	112	20	0	0
23	48	26	20	58	16	0	0
24	36	22	18	35	10	0	0
25	28	20	15	17	6	12	0
26	24	18	14	12	5	5	0
27	20	13	12	7	3	15	0

Suited for cool positions with a northern or N.E. aspect. Adapted for drawing-rooms, or other similar apartments.

See section fig. 11, and fig. 10, page 52.

Fig. 27.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

See section fig. 11, and fig. 10, page 52.

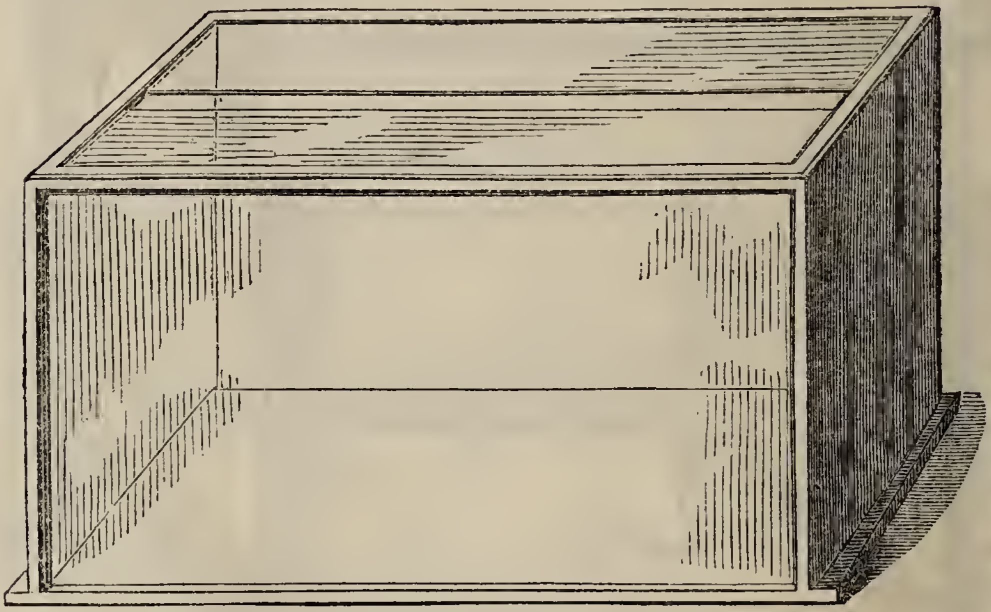
This Tank gives a large area, and it is specially adapted for actively swimming animals.

RECTANGULAR TANKS.

With Opaque Ends, Transparent Sides, and Transparent Top.

Finished Plain, with Rounded or Bevelled Edges, painted in one colour, and varnished, or varnished without paint.

Fig. 28.



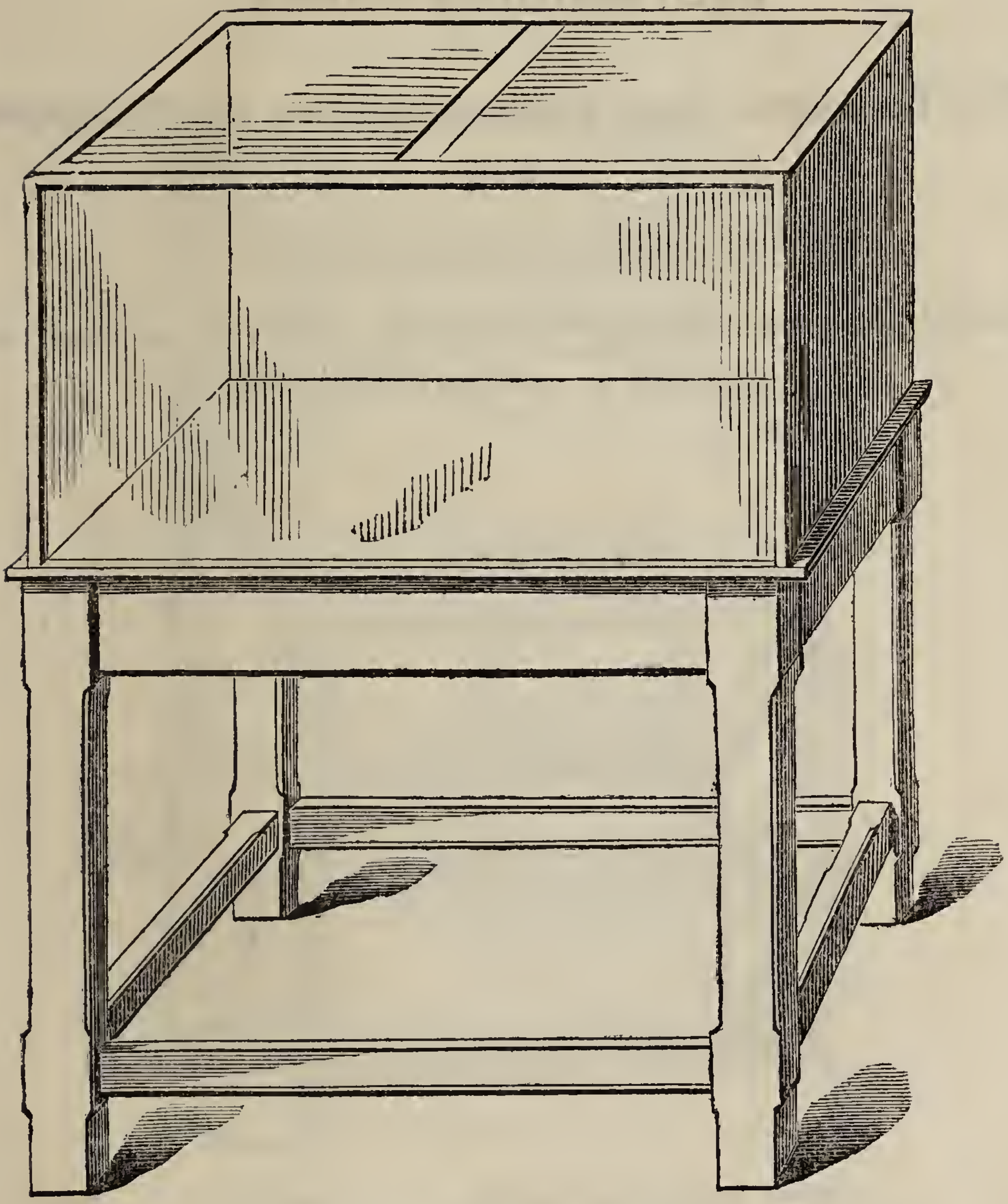
No.	Outside Size in Inches (about). Length.	Breadth.	Height.	Capacity in Gallons (about)	Price. £	s.	d.
28	72	28	22	112	17	0	0
29	48	26	20	58	12	0	0
30	36	22	18	35	6	15	0
31	28	20	15	17	4	15	0
32	24	18	14	12	3	15	0
33	20	13	12	7	2	5	0

Same remarks as to preceding Tanks.

Suited for the same general positions as those mentioned at page 70.

See section fig. 11, and fig. 10, page 52.

Fig. 29.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

See section fig. 11, and fig. 10, page 52.

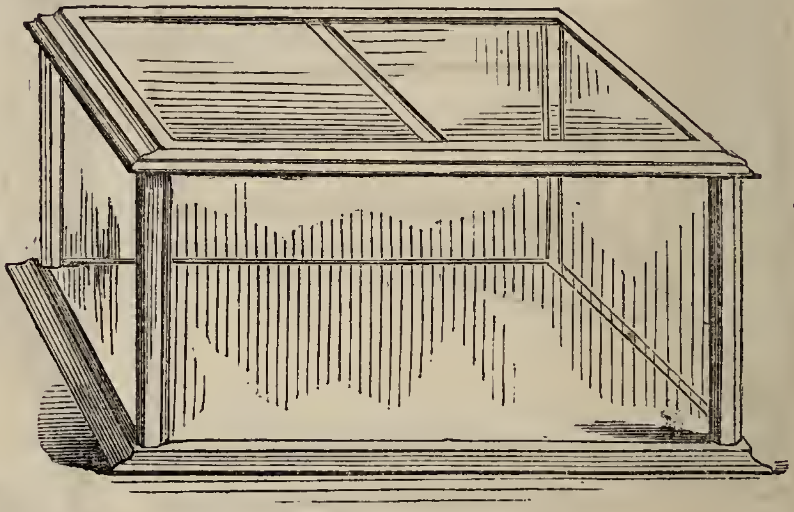
This Tank gives a large area, and it is specially adapted for animals of active habits.

RECTANGULAR TANKS.

With Transparent Ends, Transparent Sides, and Transparent Top.

Finished plain, with Moulding and Gilding, painted in one colour and varnished, or varnished without paint.

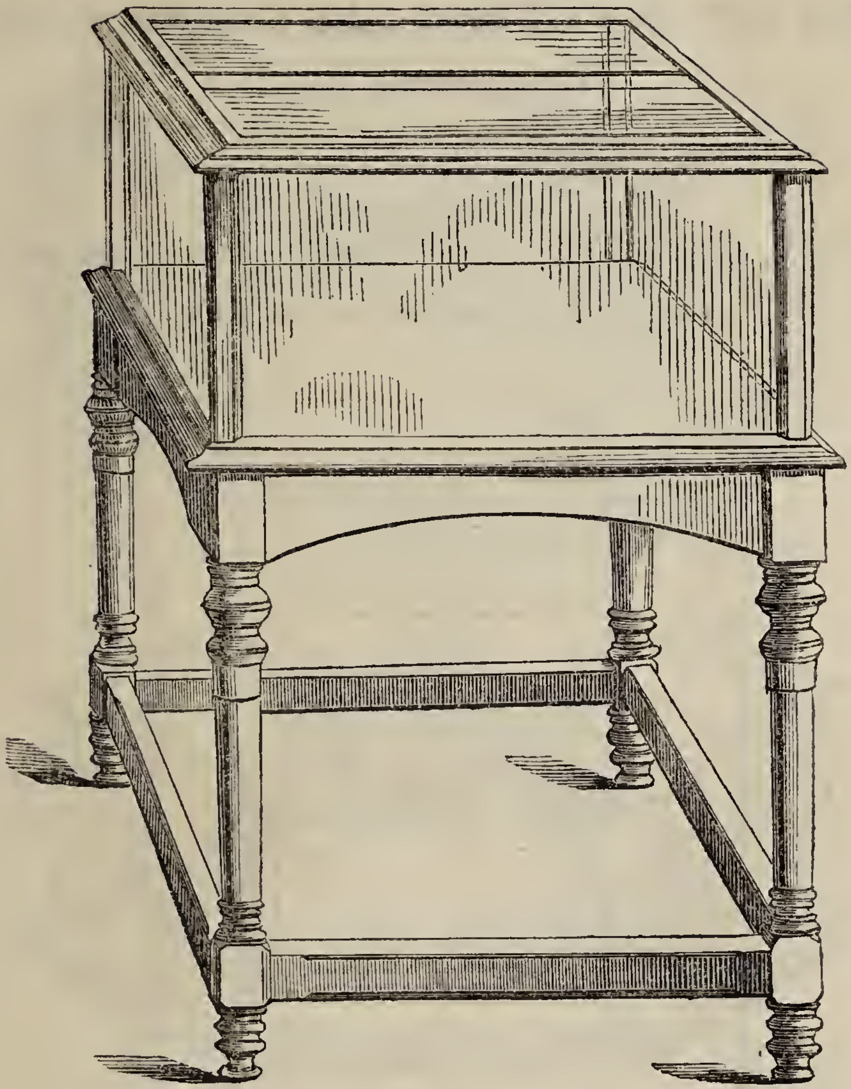
Fig. 30.



No.	Outside Size in Inches (about). Length.	Breadth.	Height.	Capacity in Gallons (about)	Price. £	s.	d.
34	28	20	15	17	6	0	0
35	24	18	14	12	3	15	0
36	20	13	12	7	2	5	0

Not generally useful.
See figs. 5, 12, 13, 14, pages 48 to 54.

Fig. 31.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

See figs. 5, 12, 13, 14, pages 48 to 54.

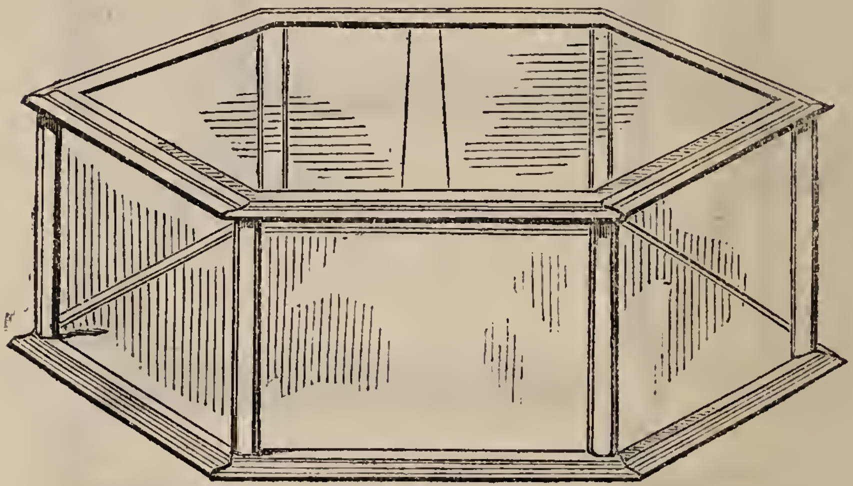
The above stand when applied to the Tanks figs. 19 and 29, relieves their excessive plainness.

HEXAGONAL TANKS.

With each Side (of equal size) Transparent, and Transparent Top.

Finished Plain, with Moulding and Gilding, painted in one colour, and varnished, or varnished without paint.

Fig. 32.

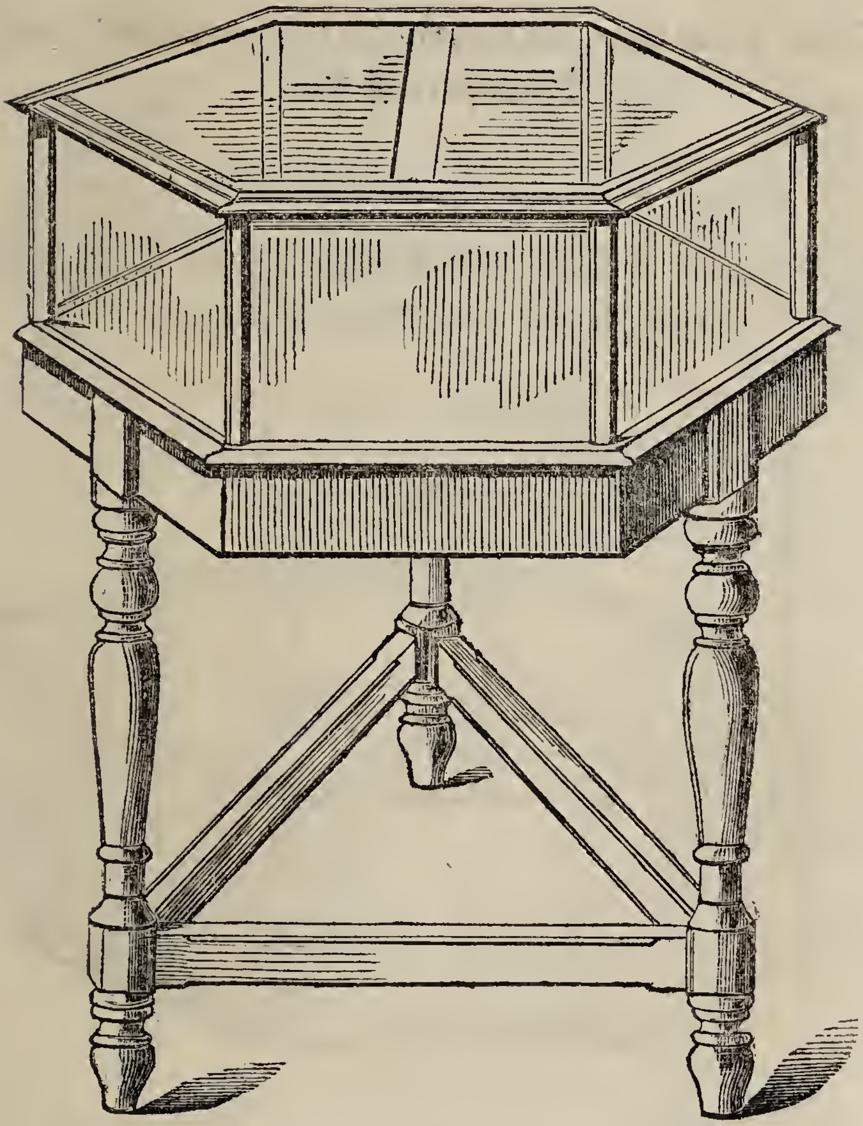


No.	Outside Size in Inches (about). Breadth.	Height.	Capacity in Gallons (about)	Price. £	s.	d.
37	30	15	30	12	0	0
38	24	12	15	10	0	0

Useful in only a very few positions. Made only to order. See page 54.

See figs. 5, 12, 13, 14, 15, pages 48 to 56.

Fig. 33.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

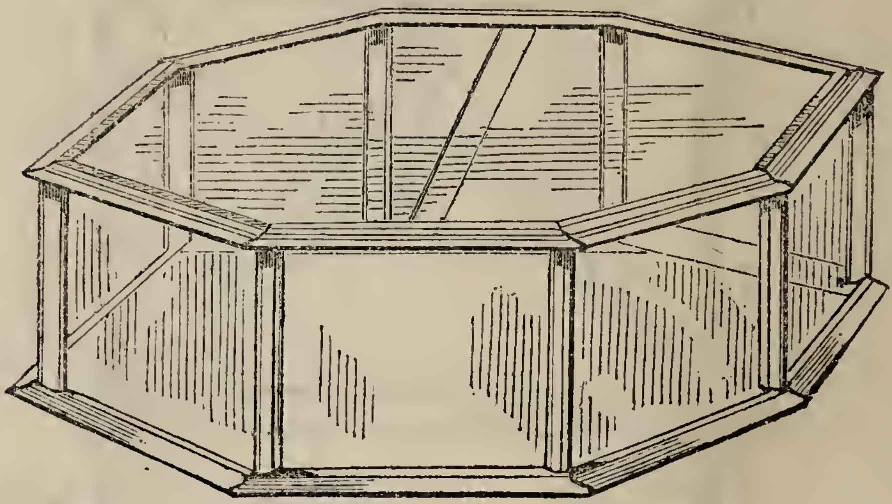
See section figs. 5, 12, 13, 14, 15, pages 48 to 57.

OCTAGONAL TANKS.

With each Side (of equal size) Transparent, and Transparent Top.

Finished plain, with Moulding and Gilding, painted in one colour, and varnished, or varnished without paint.

Fig. 34.

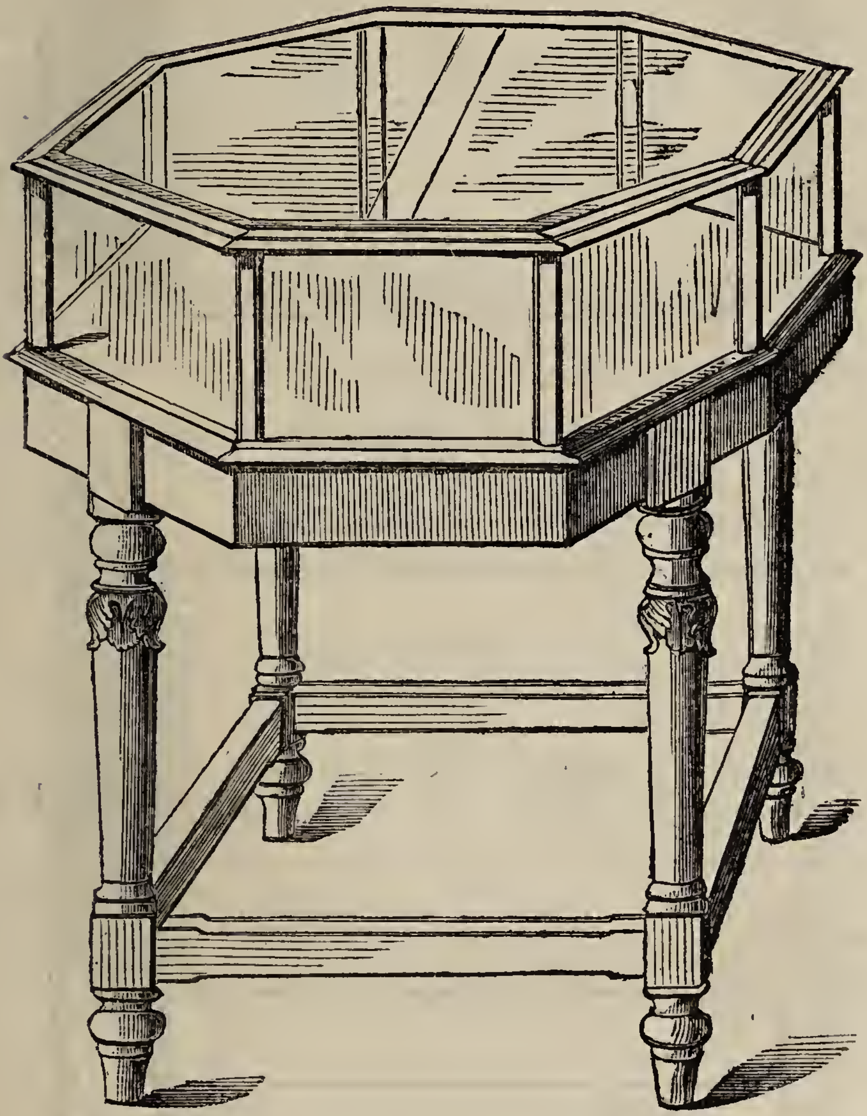


No.	Outside Size in Inches (about). Breadth.	Height.	Capacity in Gallons (about)	Price. £	s.	d.
39	30	15	30	13	0	0
40	24	12	15	11	0	0

Same remarks as foregoing, and at page 54. Made only to order.

See figs. 5, 12, 13, 14, 15, pages 48 to 57.

Fig. 35.



Same style as described on page opposite, on a stand, but the legs and other parts of the stand can be varied both as to pattern and kind of wood.

See pages 83 to 89 for patterns and prices of stands.

See figs. 5, 12, 13, 14, 15, pages 48 to 57.

Fig. 36.

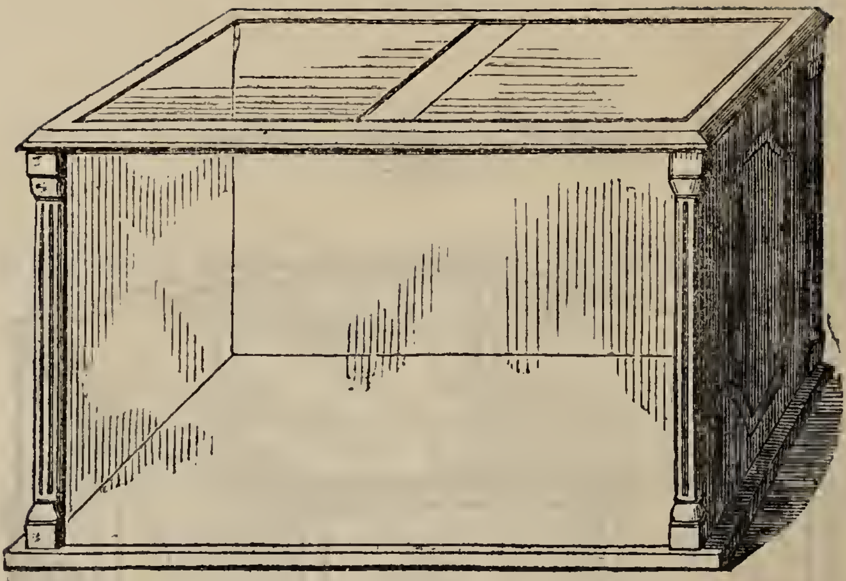
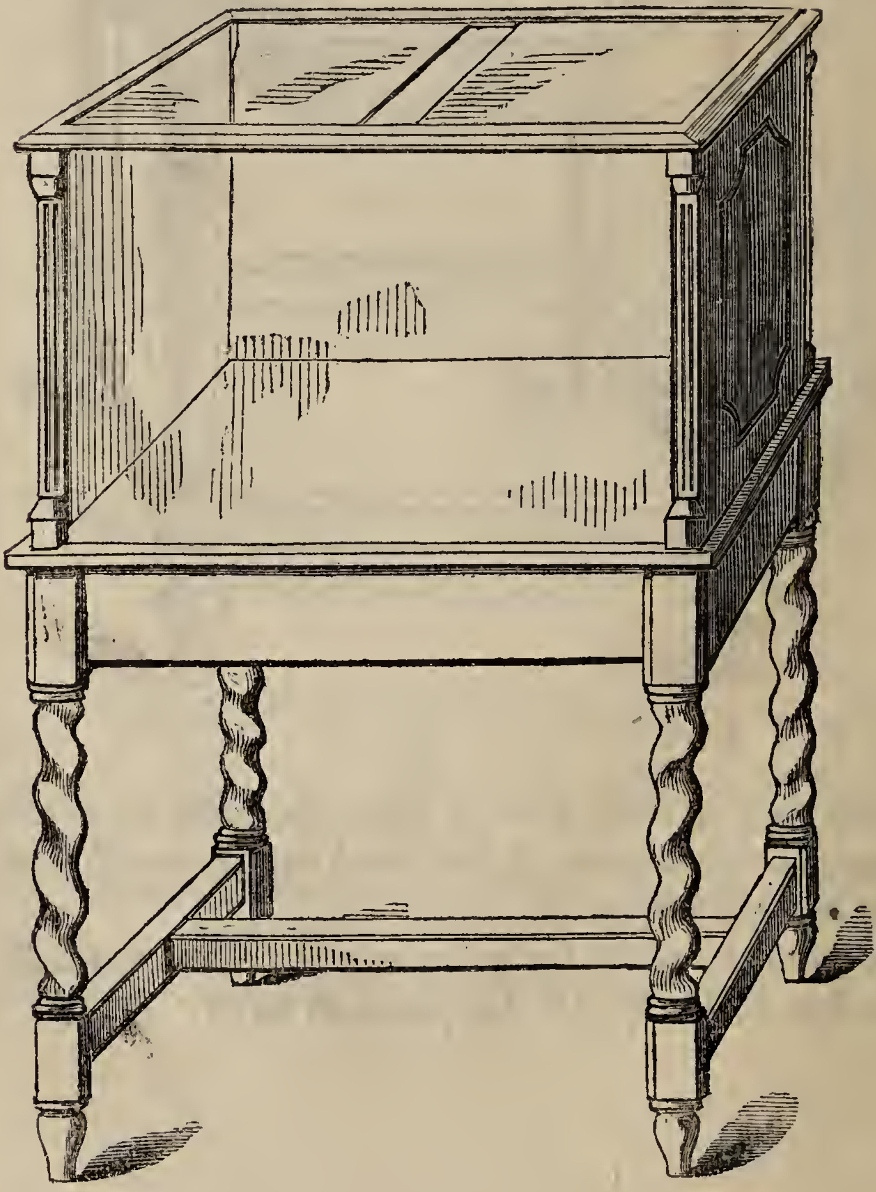
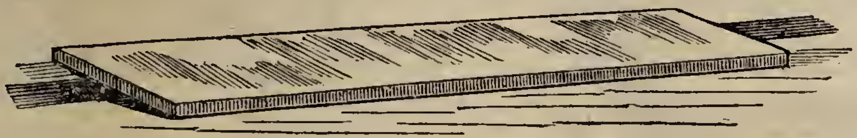


Fig. 37.



AQUARIA FOR LEECHES.

These are modifications of the Tanks previously described, and are intended for the more healthy and economical keeping of Leeches for sale in the shops of Chemists and Druggists, instead of on the old and wasteful plan of a pot of wet moss. The same general principles are applied to Leeches as to any other fresh-water animals, and the Tanks chosen for the purpose may be Nos. 25, 26, 27; or 31, 32, 33; or 34, 35, 36, according to the kind of light thrown on the spot where the Aquarium is to stand, or to the style of ornamentation required. The arrangement of the glass cover is the same, but to prevent the escape of the animals, Leech Tanks are provided with thick heavy plate (instead of sheet) glass covers, and the centre opening is covered by a third plate glass strip, removable at pleasure, as shewn in the annexed engraving. Thus sufficient air is allowed, combined with the requisite closeness.



Leech Aquaria have not yet become so general as they deserve to be (by the fact of their saving of from 50 to 75 per cent.), because hitherto the Tanks have been made too frail and uncertain, and the fastenings of the cover have not been sufficiently secure and simple. Moreover, the employment of metals for such covers, and for the frames of the Tanks, was a very serious objection, as it resulted in the formation of poisonous oxides. Slate and glass are now used.

Some receptacles for Leeches have been introduced, admitting the animals to be kept in water, but as *opaque* materials are used for the vessels here referred to, all light is excluded and consequently no vegetation can be grown in them. Therefore, that plan admits of no advantages over the old system.

See Mr. Allchinn's Report in the *Pharmaceutical Journal*, vol. xiv., and Dr. Pereira's *Materia Medica*, edited by Dr. Alfred S. Taylor, vol. 2, page 732.

Leech Tanks and stands are ten per cent. higher in price than other Tanks.

PORTABLE FISH-HATCHING APPARATUS.

Fig. 38.

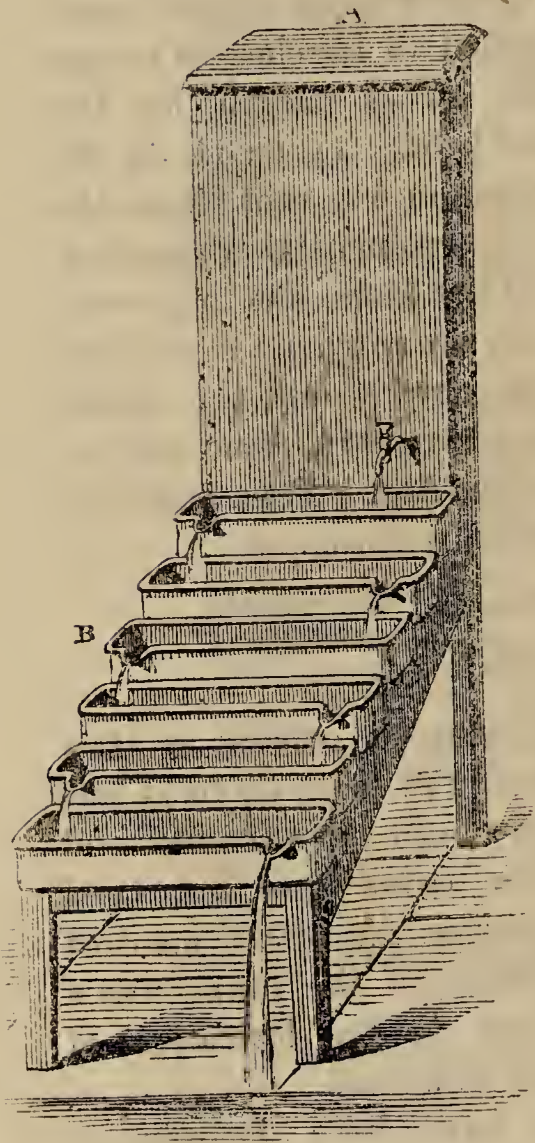


Fig. 39.

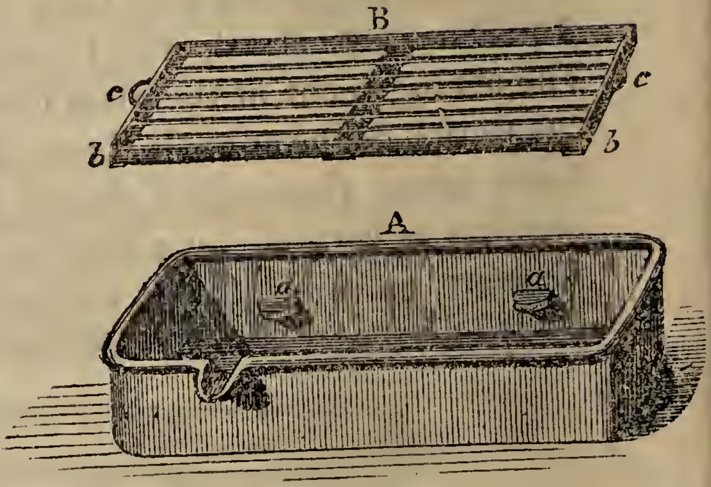


Fig. 38. The arrangement complete; A, being a reservoir of water, to be filled up when exhausted by running from the tap into the series of small troughs B.

Fig. 39. Details of one of the troughs. B, *b*, *b*, is a strainer supporting the impregnated eggs of the fish; *c*, *c*, are handles by which the strainer may be taken up to be placed on the rests *a*, *a*, of the trough A. Price £10 10s. complete.

TABLES OR STANDS FOR TANKS.

ALL Tanks need some support at a proper height from the floor or ground, but it is very seldom that any ordinary piece of household furniture is sufficiently rigid for the purpose, so as to prevent vibration. Or, if found strong and unyielding enough, it usually has some other employment, or is not of the size required, or is too expensive, or is too useful otherwise to be employed for an Aquarium. Consequently, it is recommended that a proper stand should in all cases accompany a Tank. These tables or stands are made in various patterns, and in several kinds of wood, from stained deal to walnut, or other woods, but the following enumeration is confined to four kinds of wood, with three patterns in each. The style and finish of the table should correspond with that of the Tank for which it is intended, though any combination can be made, and, as in ordering Tanks, it is necessary to name the *number* and *page*.

It will be found that although there are only sixteen tables named, yet these represent the forty kinds of Tanks *in size.* Tops are not required, thus:—

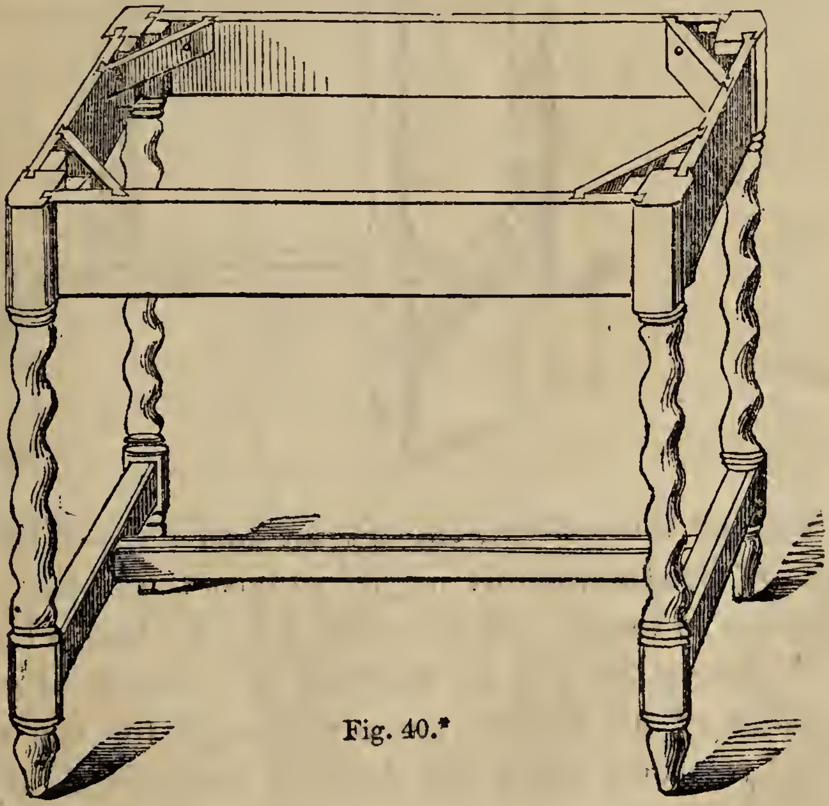


Fig. 40.*

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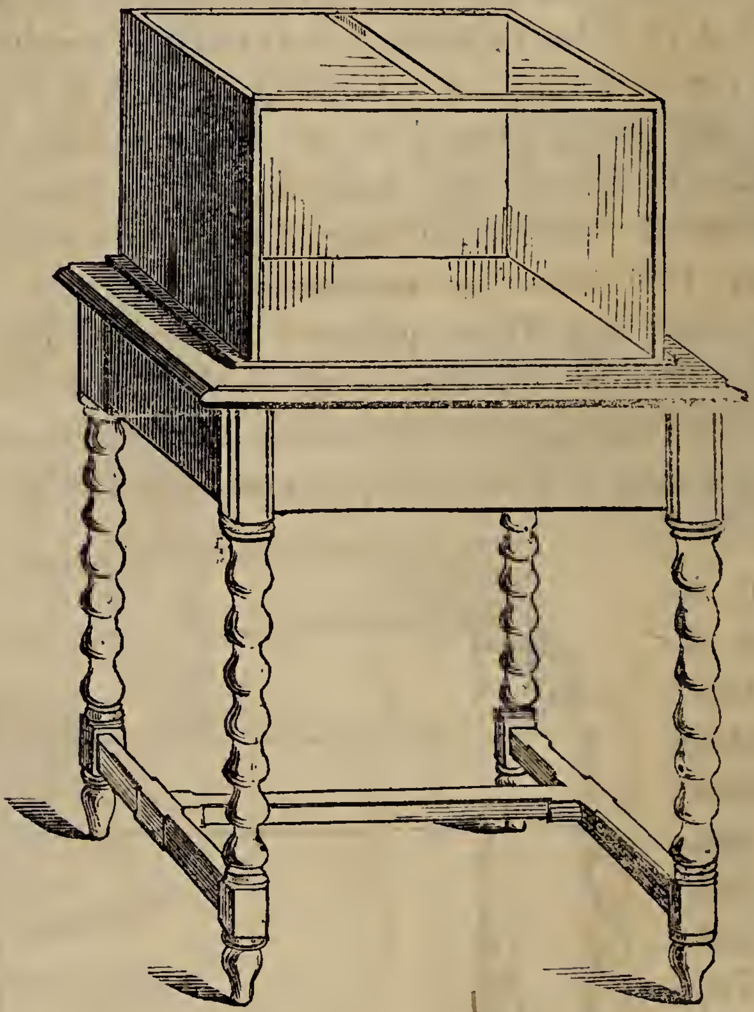
* In the smallest Tables, the angle pieces shewn above are omitted.

as the bases of the Tanks, with their edges overhanging about half an inch or an inch all round, answers that purpose.

But with the smallest Tanks, and with a few others, tops *are* provided, in order, by their projection, to afford a larger spread to the legs, and so secure the steadiness which their area would not otherwise give, thus :—

Fig. 41.



and for this reason, these least size Tank-stands will be found to be proportionably higher in cost than others. Tanks of 72 inches in length are provided with six instead of four legs.

Single leg stands, whether of wood or of metal; revolving tables of all kinds; castors (except for the smallest Tanks), and whatever else which detracts from simplicity and steadiness, are rejected.

Fig. 42.

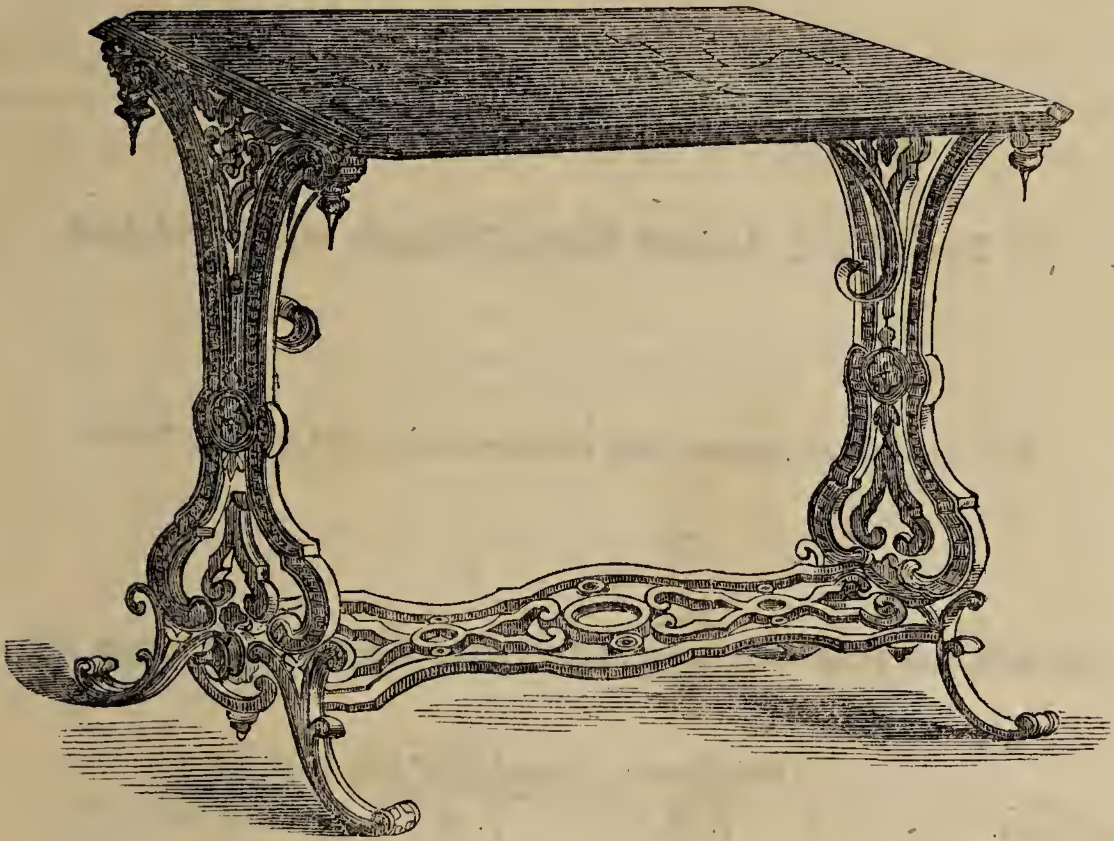
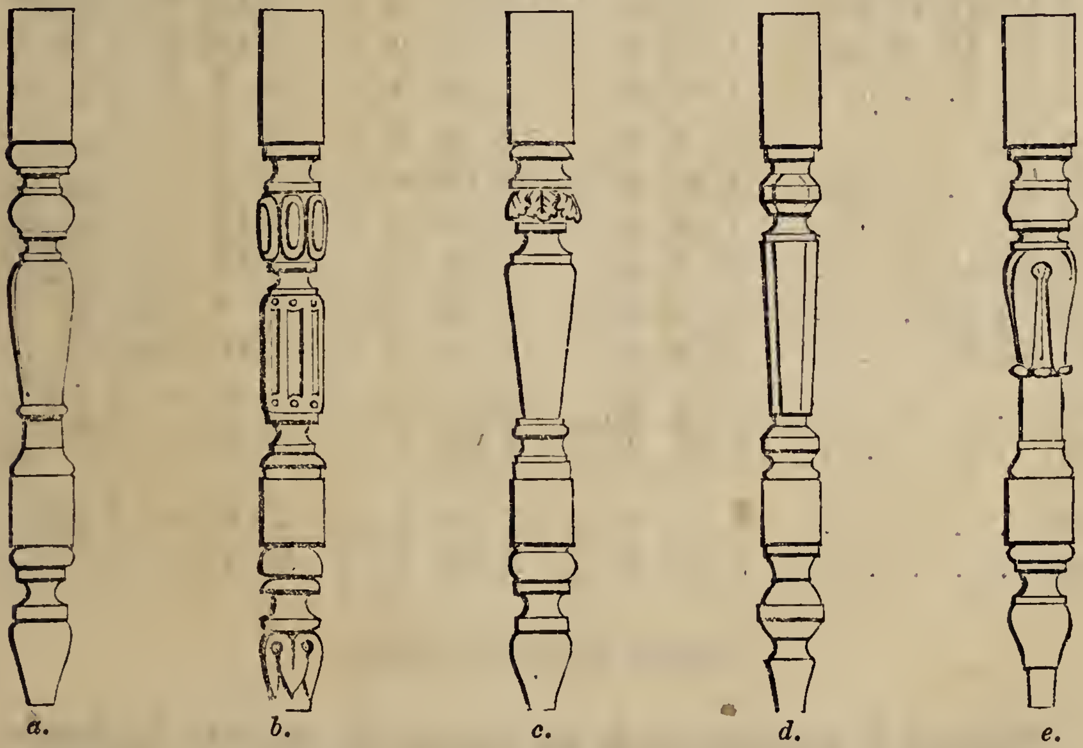


Fig. 42. Table for the support of a series of jars or vases for microscopic or general Aquarium purposes, £3 15s., size, 36 in. long.

Fig. 43.



Patterns of legs for Tank-stands. The carved work on *b* and *c*, 3s. per leg extra.

TABLE-STANDS FOR TANKS.

In Deal Wood, Stained Dark, Polished, and Varnished.

The numbers correspond with similar numbers set against Tanks.

For oak, see page 87; mahogany, page 88; walnut, page 89.

Nos. of Tanks.	Plain Square Legs. p. 63.			Turned "Ball and Hollow" Legs. p. 65.			Twisted Legs or other Patterns. p. 61 and 85.			
	£	s.	d.	£	s.	d.	£	s.	d.	
1 7	2	5	0	2	8	0	3	3	0	Slope Back Tanks. p. 60—69.
2 8	1	11	6	1	15	0	2	0	0	
3 9 13 16 19	1	10	0	1	12	6	1	17	6	
4 10 14 17 20	1	5	0	1	7	0	1	12	6	
5 11 15 18 21	1	1	0	1	5	0	1	10	0	
6 12	1	0	0	1	3	6	1	8	6	
22 28	2	3	0	2	6	0	3	0	0	Rectangular Tanks. p. 70—75.
23 29	1	10	0	1	12	6	1	18	6	
24 30	1	8	6	1	10	6	1	15	6	
25 31 34	1	3	0	1	5	0	1	10	6	
26 32 35	1	2	0	1	3	6	1	8	6	
27 33 36	1	5	0	1	6	6	1	11	6	
37	1	18	0	2	0	0	2	3	0	Hex. Tanks p. 76, 77.
38	1	16	0	1	18	6	2	0	0	
39	2	0	0	1	18	6	2	5	0	Oct. Tanks p. 78, 79.
40	1	18	6	1	16	0	2	3	0	

Carved-work is extra.

Expense of packing cases not necessary—sent in haybands.

TABLE-STANDS FOR TANKS.

In Polished Oak.

The Numbers correspond with sizes of Tanks.

For deal, see page 86; mahogany, page 88; walnut, page 89

Nos. of Tanks.	Plain Square Legs. p. 63.			Turned “Ball and Hollow” Legs. p. 65.			Twisted Legs or other Patterns. p. 61 and 85.			
	£	s.	d.	£	s.	d.	£	s.	d.	
1 7	3	0	0	3	4	0	4	4	0	Slope Back Tanks. p. 60—69.
2 8	2	2	0	2	7	6	2	15	0	
3 9 13 16 19	2	0	0	2	3	6	2	10	0	
4 10 14 17 20	1	15	6	1	16	6	2	3	6	
5 11 15 18 21	1	8	6	1	15	0	2	0	0	
6 12	1	7	6	1	13	6	1	18	6	
22 28	2	18	6	3	3	0	4	4	0	Rectangular Tanks. p.70—75.
23 29	2	2	0	2	3	6	2	15	6	
24 30	1	17	6	2	0	0	2	7	6	
25 31 34	1	11	6	1	15	0	2	2	0	
26 32 35	1	10	0	1	11	6	1	17	6	
27 33 36	1	13	6	1	15	0	2	2	0	
37	2	11	0	2	15	6	2	17	6	Hex. Tanks p. 76, 77.
38	2	8	6	2	10	6	2	15	0	
39	2	13	0	2	10	6	3	0	0	Oct. Tanks p. 78, 79.
40	2	10	6	2	8	0	2	17	6	

Carved-work is extra.

Expense of packing cases not necessary—sent in haybands.

TABLE-STANDS FOR TANKS.

In Polished Mahogany.

Numbers correspond with sizes of Tanks.

For deal, see page 86; oak, page 87; walnut, page 89.

Nos. of Tanks.	Plain Square Legs, p. 63.			Turned "Ball and Hollow" Legs. p. 65.			Twisted Legs or other Patterns. p. 61 and 85.			
	£	s.	d.	£	s.	d.	£	s.	d.	
1 7	3	7	6	3	12	6	4	14	6	Slope Back Tanks. p. 60—69.
2 8	2	7	6	2	12	6	3	3	0	
3 9 13 16 19	2	5	0	2	8	6	2	17	6	
4 10 14 17 20	1	17	6	2	0	0	2	8	6	
5 11 15 18 21	1	11	6	1	17	6	2	5	0	
6 12	1	10	6	1	16	0	2	3	0	
22 28	3	5	0	3	10	0	4	10	0	Rectangular Tanks. p. 70—75.
23 29	2	5	0	2	8	6	2	17	6	
24 30	2	2	0	2	5	6	2	12	6	
25 31 34 . . .	1	15	0	1	17	6	2	7	6	
26 32 35 . . .	1	13	6	1	15	6	2	3	6	
27 33 36 . . .	1	17	6	2	2	0	2	9	0	
37	2	17	0	3	0	0	3	5	0	Hex. Tanks p. 76, 77.
38	2	15	0	2	17	0	3	0	0	
39	3	0	0	2	17	6	3	7	6	Oct. Tanks p. 78, 79.
40	2	17	6	2	15	0	3	5	0	

Carved-work is extra.

Expense of packing cases not necessary—sent in haybands.

TABLE-STANDS FOR TANKS.

In Polished Walnut-Wood.

Numbers correspond with those of Tanks.

For deal, see page 86, oak, page 87; mahogany, page 88.

Nos. of Tanks.	Plain Square Legs. p. 63.			Turned "Ball and Hollow" Legs. p. 65.			Twisted Legs or other Patterns. p. 61 and 85.			
	£	s.	d.	£	s.	d.	£	s.	d.	
1 7	3	15	0	4	0	0	5	15	0	Slope Back Tanks. p. 60—69.
2 8	2	12	6	2	18	6	3	7	6	
3 9 13 16 19	2	10	0	2	13	6	3	2	6	
4 10 14 17 20	2	2	0	2	5	0	2	15	6	
5 11 15 18 21	1	15	0	2	2	0	2	10	0	
6 12	1	13	6	2	0	0	2	8	6	
22 28	3	12	6	3	17	6	5	5	0	Rectangular Tanks. p. 70—75.
23 29	2	10	0	2	13	6	3	3	6	
24 30	2	7	6	2	10	0	3	0	0	
25 31 34	1	18	6	2	2	0	2	10	0	
26 32 35	1	17	6	2	0	0	2	7	6	
27 33 36	2	2	0	2	5	0	2	12	6	
37	3	5	0	3	7	6	3	12	6	Hex. Tanks p. 76, 77.
38	3	0	0	3	5	0	3	7	6	
39	3	7	6	3	5	0	3	15	0	Oct. Tanks p. 78, 79.
40	3	5	0	3	0	0	3	12	6	

Carved-work is extra.

Expense of packing cases not necessary—sent in haybands.

VESSELS FOR AQUARIA.

Blown or Cast in one Piece, of Cylindrical, Vase, or other shape, and constructed of Glass or Earthenware.

It has been a great mistake to adopt, for Aquarium purposes, vessels made in one piece, and of too large size, for two reasons, namely, because the *risk of breaking* from too great a pressure of water, from imperfect annealing, from a slight blow or vibration, or from the minute scratch of a fragment of shingle or grain of sand, increases enormously as the capacity is increased, and therefore twelve inches of diameter, and ten or twelve of height, should be the utmost limit (beyond which there is less certainty), except in flat pan-like vessels, and in specially-made tall ones. The other reason against large size, is, that such vessels being *transparent* on every side, and admitting of no shadows, it is often found desirable to remove them in summer time to cool places, and this, obviously, cannot be done when full, if very weighty and large.

Of these receptacles there are four principal kinds, viz. :—

1. Vase or bell-shaped glasses, with a knob projecting from the bottom, which is inserted in a hollow space in a circular stand of turned and polished wood, thus:

Sizes and prices at page 94.

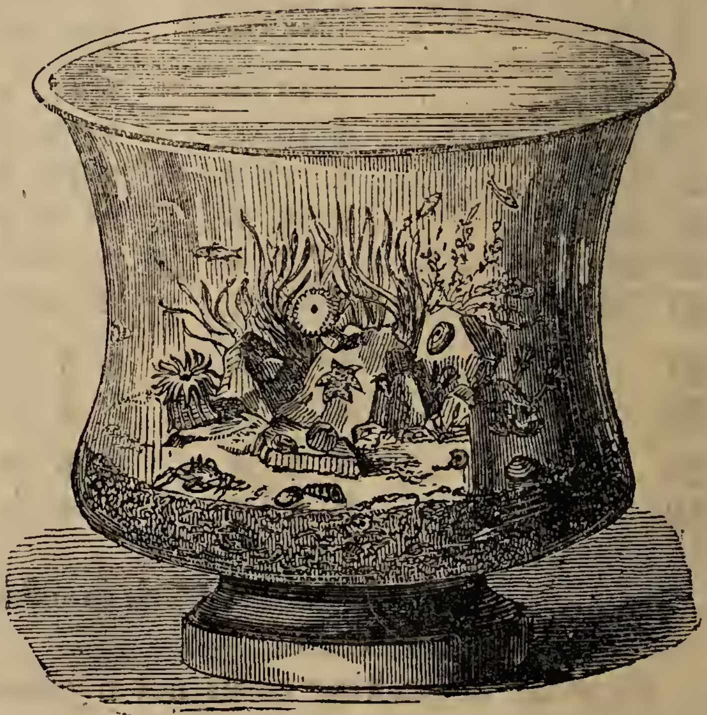
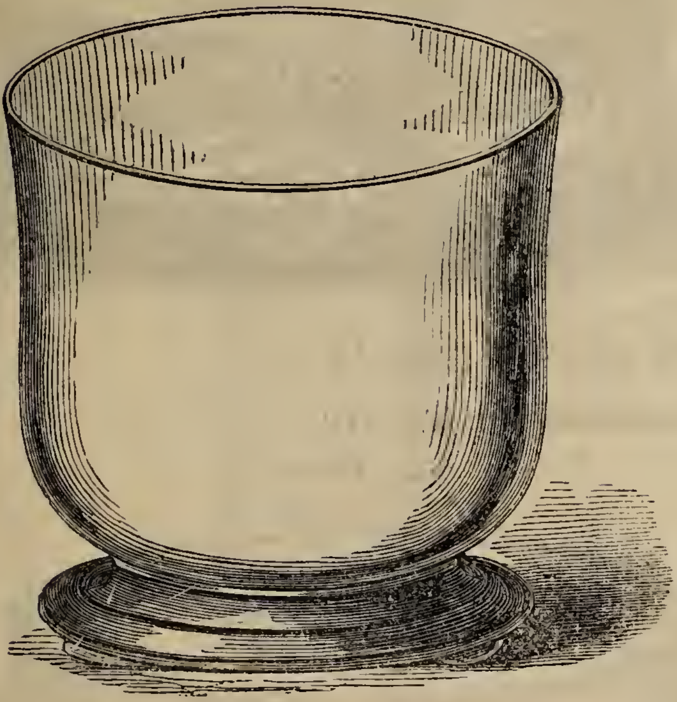


Fig. 44.

Or thus:—

Fig. 45.



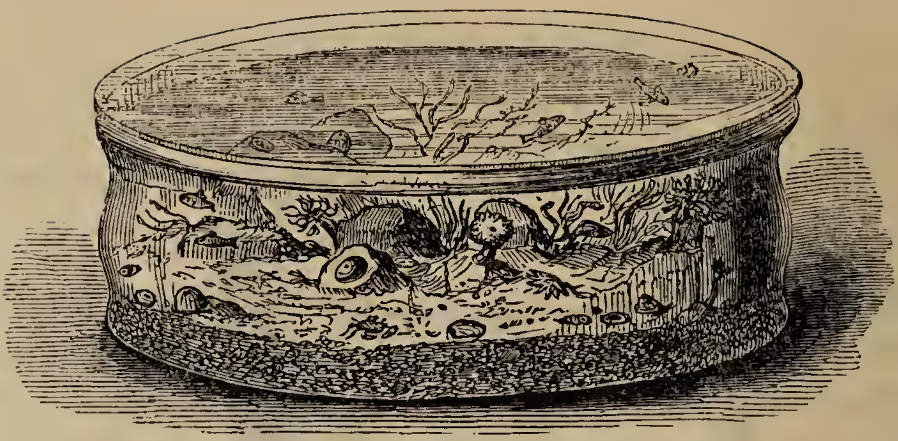
Sizes and prices at page 94.

These are made specially for Aquarium purposes, and are not, as formerly, adaptations of the common "propagators," used for horticultural purposes, and which are not prepared to hold water.

2. Ordinary "fish globes." The shape of these is well known, and therefore no engraving is given. They are the vessels formerly used for gold and silver fish before the introduction of Aquaria on the compensating principle, and they are still as effective as any other vessels approaching the same form. They seldom, if ever, crack from imperfect annealing. Sizes and prices at page 94.

3. Cylindrical vessels. Of these there are several proportions, viz.: those in which the width greatly exceeds the height, in glass, fig. 46:—

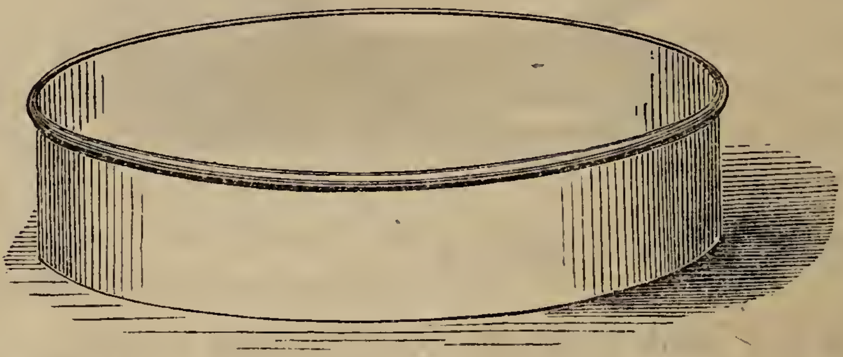
Fig. 46.



Sizes and prices at page 94.

Or, in earthenware, fig. 47 :

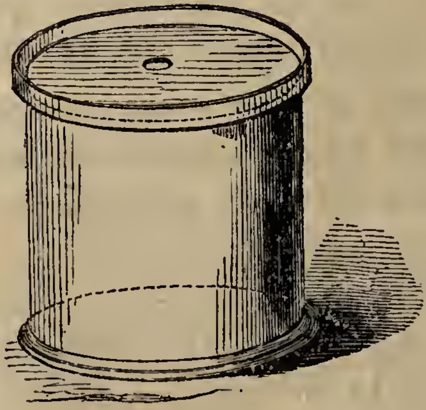
Fig. 47.



Sizes and prices at page 94.

Then there are those in which the height and width are equal :—

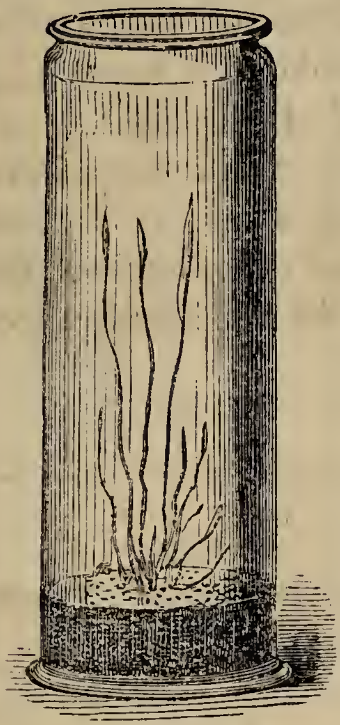
Fig. 48.



Sizes and prices at page 94.

And those in which the height exceeds the width:—

Fig. 49.



Sizes and prices at page 94.

Nos. 44 and 45 are adapted for use as small Aquaria. Nos. 46 and 47 are for the same purposes, and are also very useful when employed as subsidiary vessels or "hospitals," in conjunction with regular square "Tanks;" and, indeed, every Aquarium should have such an appendage for the occasional reception of creatures or plants in doubtful health.

No. 48 is for general purposes—to contain and isolate small and delicate objects requiring care and separate examination. (See a table for containing a number of jars at page 85).

No. 49 is principally for the purpose of containing Valisneria and other tall-growing freshwater plants.

The thickened foot of these two jars add much to their strength.

As in Tanks, glasses should always be kept covered by a disc or plate of glass, either laid upon the top, or, better, sunk in a shoulder and perforated with a finger hole in the centre, to lift it off and on, and to admit air, as in fig. 48. When no such hole exists, the cover should be raised a little by wedges of wood or of cork.

As glasses are transparent on every side, and as they are therefore to a great extent contrary to right principles, they should, as an invariable rule, never be placed in aspects commanding a direct and strong light, even when such light is not accompanied by heat, as in the winter time. Their right situation is in shady spots, as between windows, or in the corners of rooms, and other similar places. See the observations on Tanks, page 45 to 59, and especially the points marked V. and VI., page 55.

	About		s.	d.	
Fig. No. 44 and 45.	8 inches diameter	7 inches high	6	0	with stand and cover.
	10 ,,	9 ,,	7	0	
	12 ,,	11 ,,	8	0	
Fig. No. ~~44 or 45.~~ 46 or 47	18 ,,	8 ,,	13	6	with cover.
	12 ,,	6 ,,	7	6	
Fig. No. 48 . . .	8 ,,	8 ,,	6	6	
	6 ,,	6 ,,	5	6	
Fig. No. 49 . . .	6 ,,	16 ,,	8	6	
	5 ,,	14 ,,	4	6	
	4 ,,	10 ,,	2	6	
Fish Globes . .	10 ,,	8 ,,	2	9	
	12 ,,	10 ,,	3	9	

VARIOUS APPARATUS AND APPLIANCES.

Fig. 50.

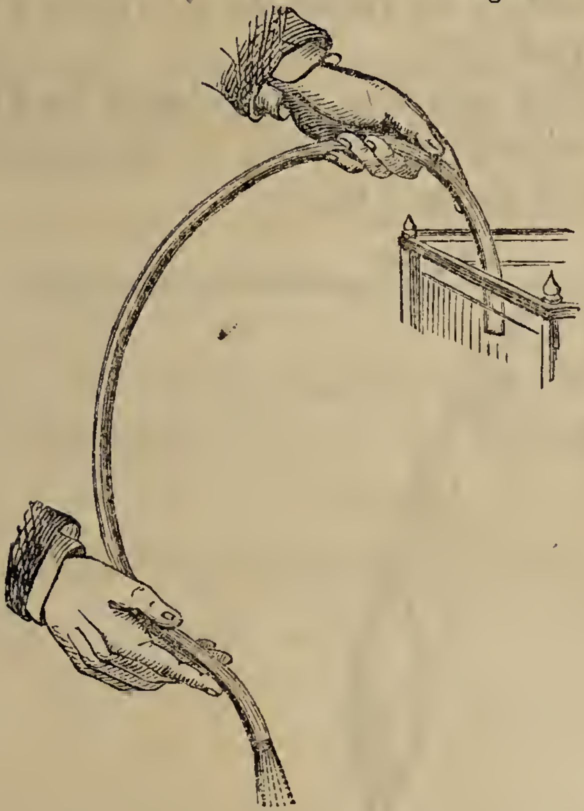


Fig. 50. Syphon of gutta-percha to draw off water when required, or to remove sediments, 6d. per foot, seven feet generally necessary, 3s. 6d.

It is in this simple form that syphons are most effective. They are sometimes provided with an exhausting ball, or with a kind of piston, but these invariably get out of order.

Fig. 51.

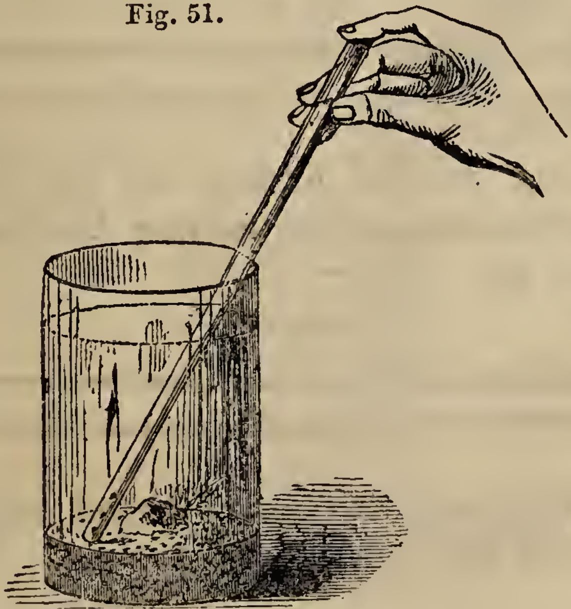


Fig. 51. Glass tube for dipping out offensive semi-fluid matters without contaminating the water. Represented here as applied to a jar, but when used for a tank of any but the smallest size, the pipe is grasped with both hands. 18 inches long and $\frac{3}{4}$ inch diameter, 1s. each, or packed in a box separately for the country, 2s. A series of six (price 4s. 6d., or in a box 5s.) are useful in case of breakage.

Similar but smaller tubes with the point drawn to a fine point for the removal of microscopic objects for examination, 6d. each, or 2s. 6d. per set of six, in a box.

Fig. 52.

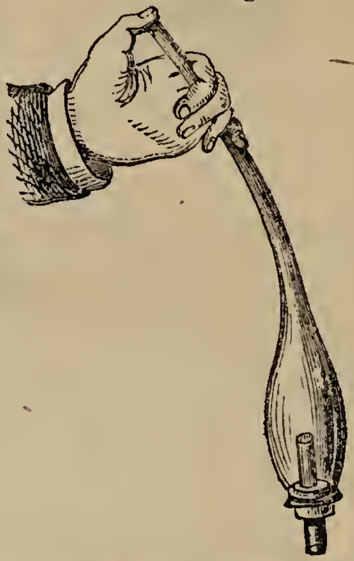


Fig. 52. "Trap" dipping tube for arresting objects in the enlarged portion, for temporary examination, 1s. 6d. and 2s.

Fig. 53.

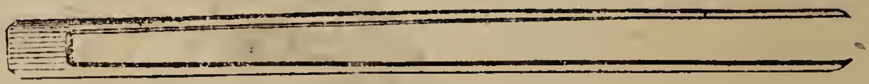


Fig. 53. Long wooden forceps for the introduction or removal of small objects, and for feeding Anemones, &c.; with straight ends, 2s. 6d.

Fig. 54.

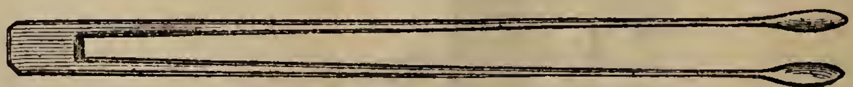


Fig. 54. The same, with spoon-shaped ends, for larger or heavier objects, 3s. 6d.

Fig. 55.

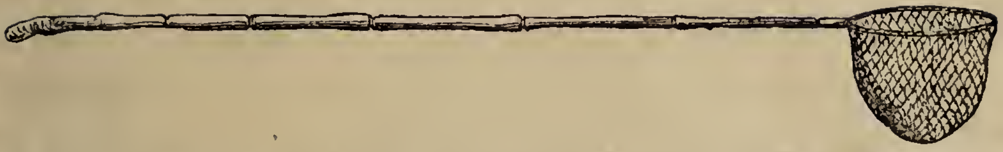


Fig. 55. Net with small meshes for the introduction or removal of actively swimming objects, 6d., 9d., and 1s.

Fig. 56.

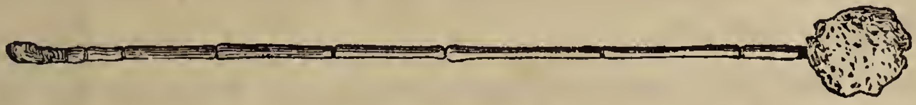


Fig. 56. Sponge-stick to wipe off deposits or growths on the inner sides of glass in Aquaria, 6d. and 1s.

Fig. 57.

Fig. 57. Glass rod to remove or adjust objects, 6d.

Fig. 58.

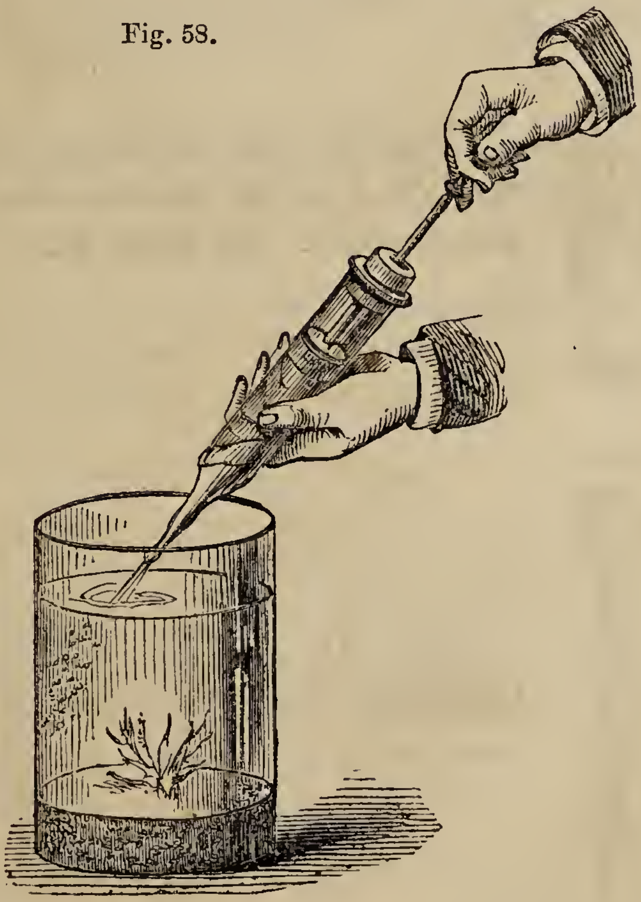


Fig. 58. Syringe for aëration (the forcible driving of air bubbles into water) in cases of foulness, 1s. 6d., 2s., 2s. 6d.

In the figure a glass syringe is shewn, but the instrument is best in pewter, and sea-water does not act injuriously on that compound metal.

Fig. 59.

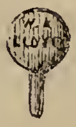


Fig. 59. Specific-Gravity Ball to indicate and regulate density of sea-water, in box, with printed instructions, 1s., or by post, 1s. 3d.

A pair of the above-named balls made to act in concert and of different colours, one to swim, and one to sink, 2s. per pair in a box, with printed instructions, or by post, 2s. 3d.

Two balls indicate with more precision than one.

*** N.B. When specific-gravity balls are ordered alone, and to be sent by post, it is requested that *pre-payment* be made in stamps, as the instruments are kept ready sealed up in packets, and no invoice can be enclosed without trouble and extra postage.

Fig. 60.

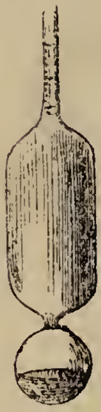


Fig. 60. Hydrometer, to indicate density. Scale marked with ten degrees, 5s., in a box, with printed instructions. By post, 6s.

Fig. 61.

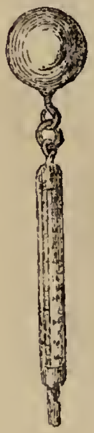


Fig. 61. Floating Thermometer, to indicate temperature of the water in an Aquarium, 4s., in a case, or 5s. post free. All of glass.

Fig. 62.

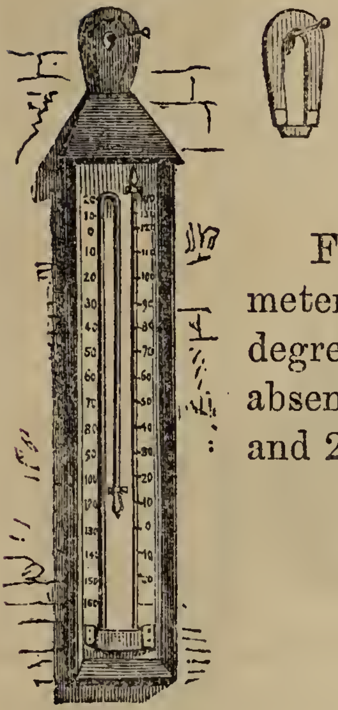


Fig. 62. Doubly self-registering Thermometer to indicate the highest and the lowest degree of heat and of cold, in the observer's absence, with magnet and keeper complete, 18s. and 20s.

Fig. 63.

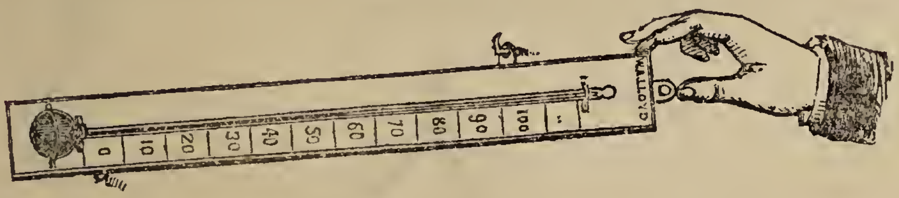


Fig. 63. Singly self-registering Thermometer. In ordering, it should be stated if wanted for "heat" or for "cold," 4s. 6d. each.

These two instruments (62 and 63) are very important in Aquarium practice.

Fig. 64.

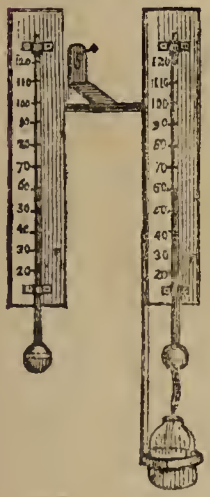


Fig. 64. Hygrometer, to regulate the amount of water existing in the atmosphere of a room, with a view to the prevention of deposits of wet on the exterior of Aquaria, as caused by condensation, 7s. 6d.

Fig. 65.

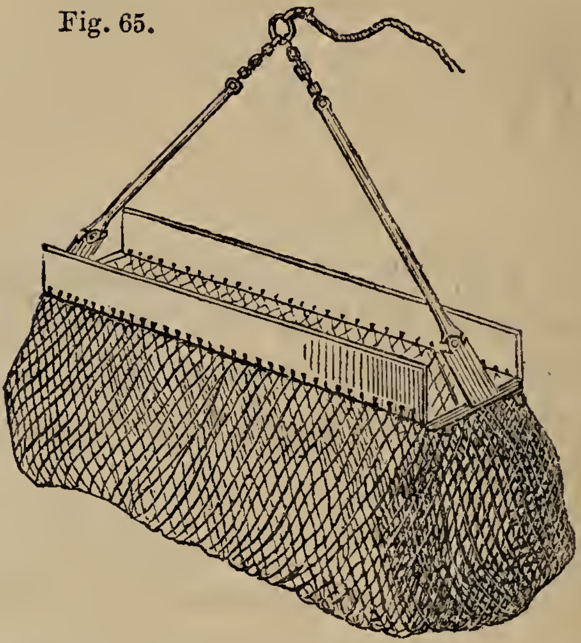


Fig. 65. Ball's Dredge for bottom collecting with net complete, 18s.

*** From its lightness and portability, this instrument is adapted for freshwater as well as for marine purposes.

Fig. 66.

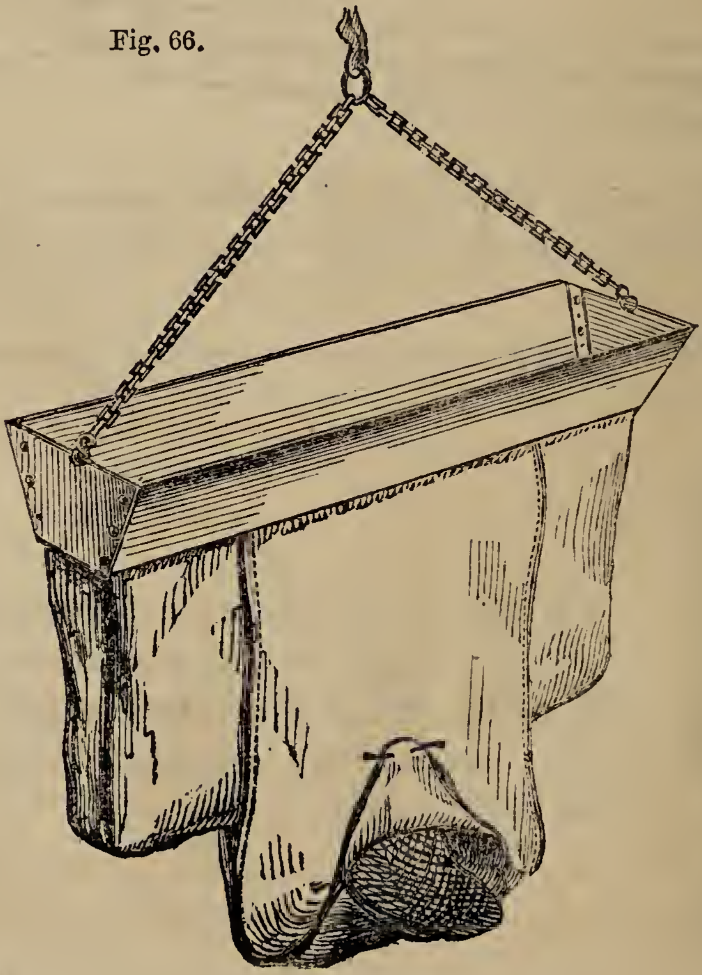


Fig. 66. Another Dredge for bottom collecting; a very useful and substantial form. The bag is of strong sail-cloth, and the internal net is well protected from rocks and entanglement by a double flap of sail-cloth, shewn pinned up in the drawing to exhibit the net inside, £1. 10s.

Fig. 67.

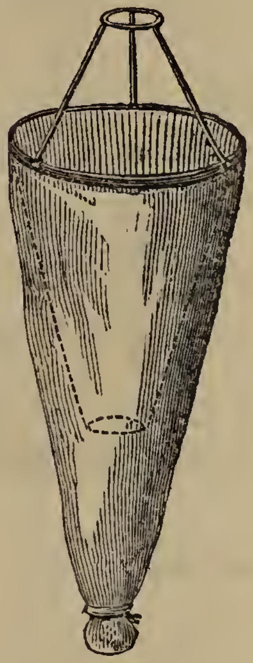


Fig. 67. Towing-net of fine muslin, for surface collecting, with an inner net (shewn in outline) to prevent regurgitation. The small end being made to untie; for Medusæ, &c., 5s., 7s. 6d.

Fig. 68.

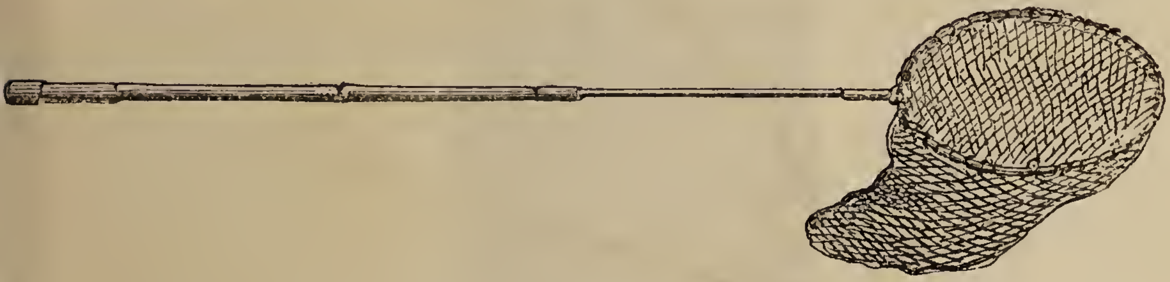


Fig. 68. Hand-net for collecting large marine or fresh-water objects. Made very portable, the handle being "telescopic" (one part sliding within the other); length when shut up 29 inches, or when out 50 inches. The ring 12 inches diameter, unscrews and folds up into a segment of a circle 4 inches broad. In bamboo, brass mounted, and screw cap, with double net complete, 8s. 6d. When required, a smaller ring (not folding) fitted with "sampler cloth" for collecting microscopic objects, can be obtained for the above, at the same price.

Fig. 69.

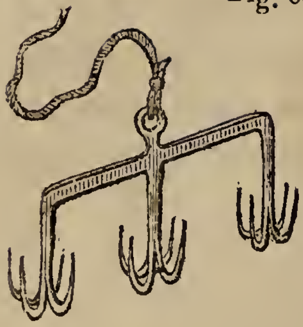


Fig. 69. Drag for marine collecting, 5s.

Fig. 70.

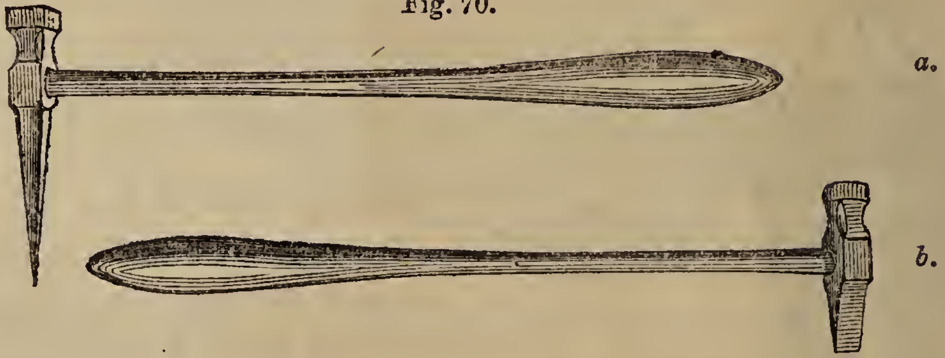


Fig. 70. Hammers for marine collecting, and for geological purposes, with mahogany handles and hard steel faces and points, 3s., 3s. 6d., to 5s.

⁂ State shape when ordering. Other shapes are kept.

Fig. 71.

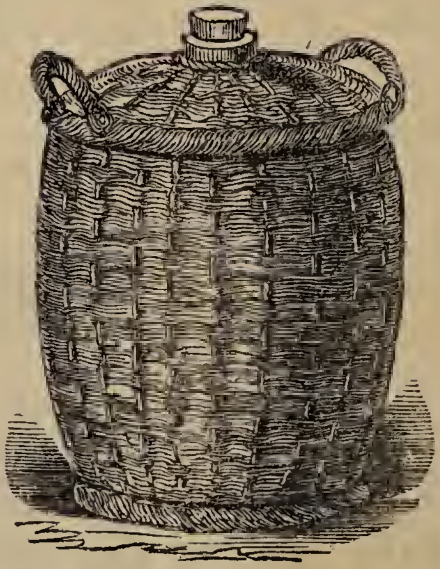


Fig. 71. Stone bottle in wicker-work, for sea-water, or for the transmission of objects which do not suffer from being corked up, 6 gallons 6s. 6d., 3 gallon 4s. 6d., 2 gallon 3s. 6d., 1 gallon 2s. 6d.; larger quantities of sea-water than 6 gallons are sent in casks of from 9 to 90 gallons capacity.

Fig. 72.

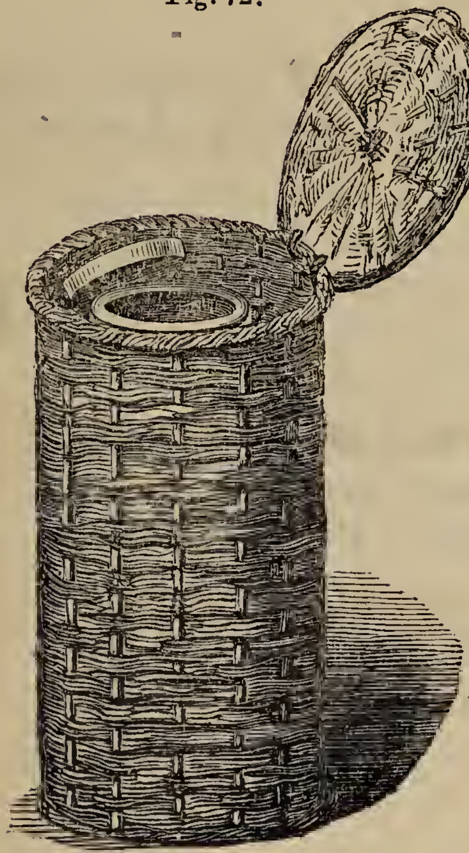


Fig. 72. Stone opened-mouthed jar in wicker-work, for the conveyance of Fishes, &c., with vacant space at top in which to pack sea-weeds and other objects not requiring water for their transmission, 6 gallon, 6s. 6d., 3 gallon, 4s. 6d., 2 gallon, 3s. 6d., 1 gallon, 2s. 6d.

Fig. 73.

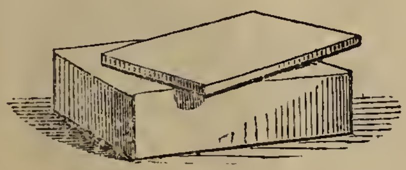


Fig. 73. Tin box for conveyance of living marine and other animals and plants *by post*, 4d. Larger sizes, for post and rail, 6d., 8d., and 1s.

Fig. 74.

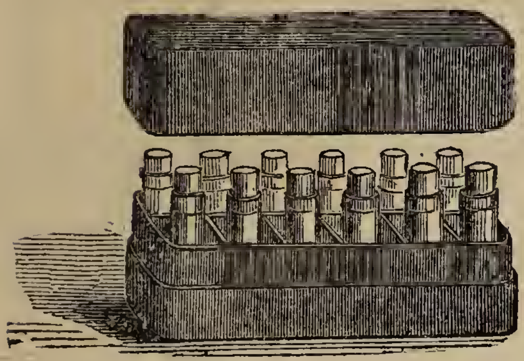


Fig. 74. A series of twelve glass bottles (made without necks) in a case, for animalcule collecting, 7s. 6d.

Fig. 75.

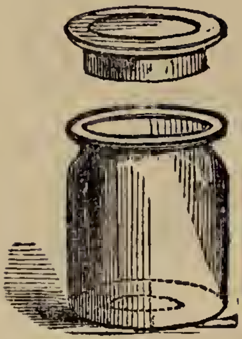


Fig. 75. Wide mouth glass bottle and glass cap, for animalcule collecting, 6d., 9d.

Fig. 76.

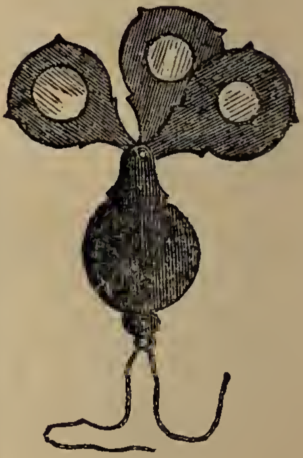


Fig. 76. Pocket Magnifiers. In horn, one lens 2s.; two lenses 3s.; three lenses 4s. 6d. In tortoiseshell, with three lenses carefully adjusted to act together or separately, best make, very thin and portable, with ring for suspension, 12s. 6d.

Fig. 77.

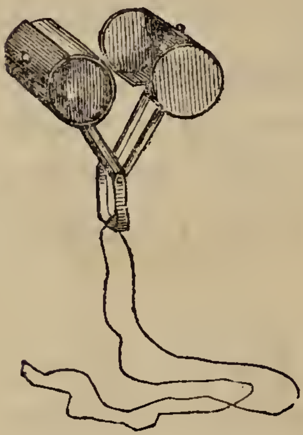


Fig. 77. Coddington Lens, in sterling silver, 18s.; in German silver, 10s. 6d.

⁂ The focus of a Coddington lens is short, but the field is flat even when the instrument is held obliquely.

Fig. 78.

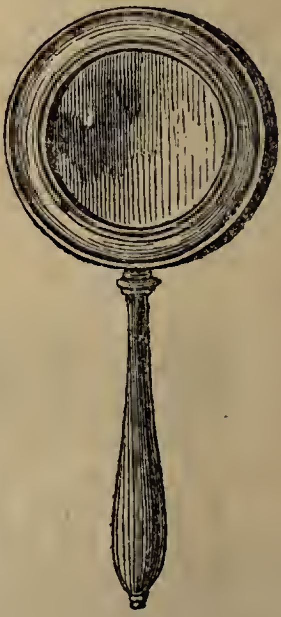


Fig. 78. Hand glass of shallow magnifying power, large field, and long focus, mounted in wood, in ivory, or in German silver, 5s. to 25s.

Fig. 79.

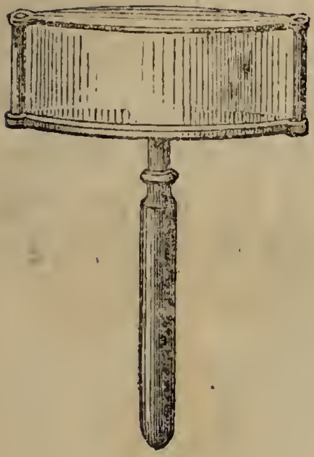


Fig. 79. Hand glass of shallow magnifying power, large field, and long focus, but instead of the lens being a segment of a *sphere*, it is composed of a longitudinal and a transverse segment of a *cylinder*, and thus aberration is largely corrected. The unnecessary marginal portions are cut off. Mounted in metal, 7s. to 15s.

Fig. 80.

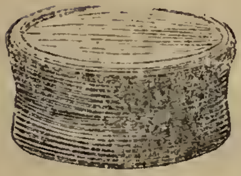
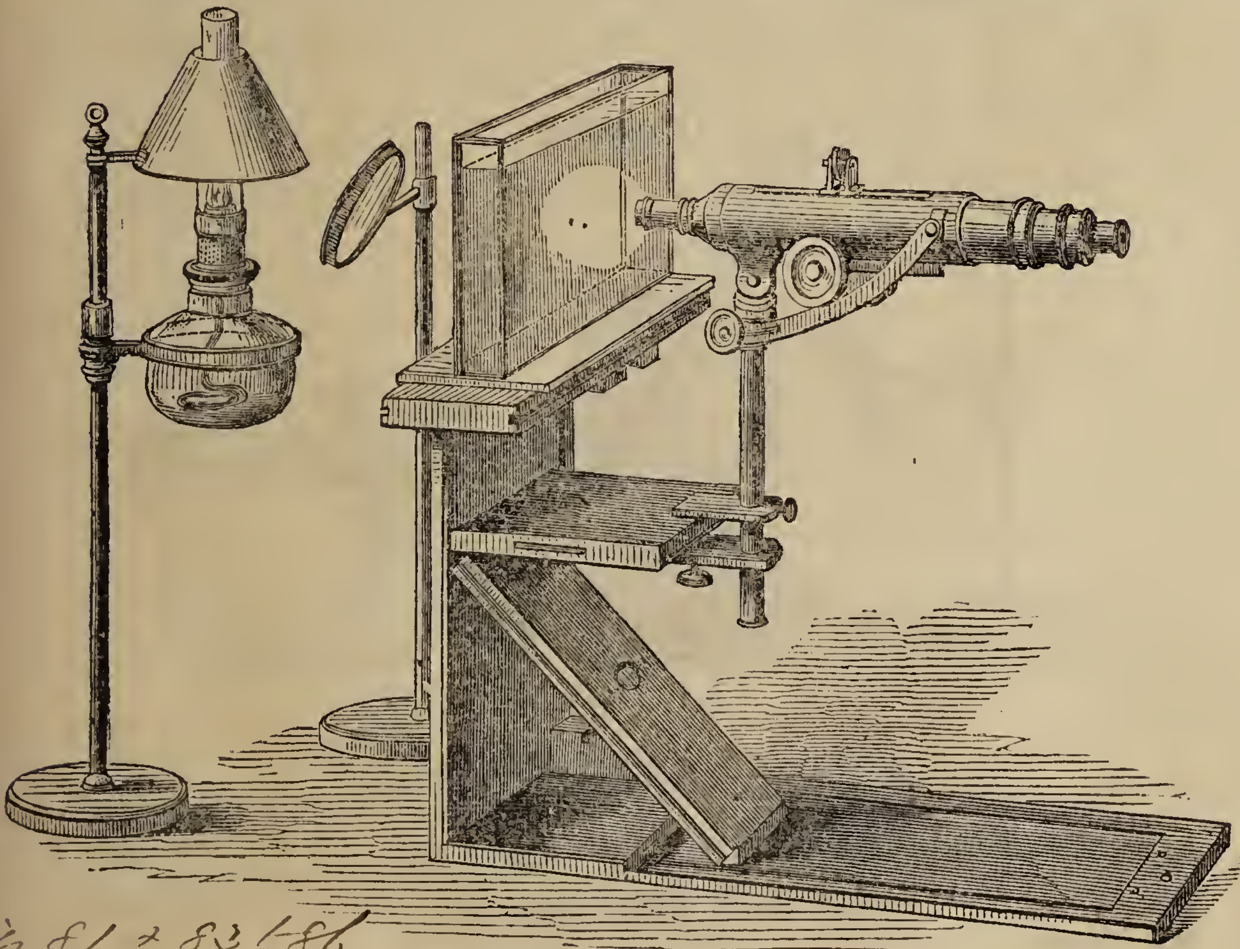


Fig. 80. Two "cylinder" lenses acting together in a frame, 6s. and 7s. 6d.

Fig. 81.



Figs 81 + 82–86
Manufd by Pastorelli of Piccadilly

Fig. 81. Compound Microscope, arranged for the observation of Aquatic objects in a large glass cell, £6. 16s. This sum includes the "body" of the microscope with the stand and clamps and one eye-piece, but not the object glasses, nor the cell, nor the condenser, nor the lamp. A set of good foreign achromatic object glasses combining for high or for low powers, is about 50s. A condenser is 15s. and 20s., and a lamp is 7s. 6d. to 40s.

Large glass cells separately 5s., 10s., 15s., 20s.

Fig. 82.

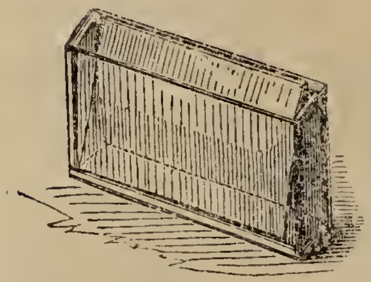


Fig. 82. Smaller glass cell or trough with diaphragm, for placing on the inclining stage of a microscope, 2s. 6d., 4s. 6d.

Fig. 83.

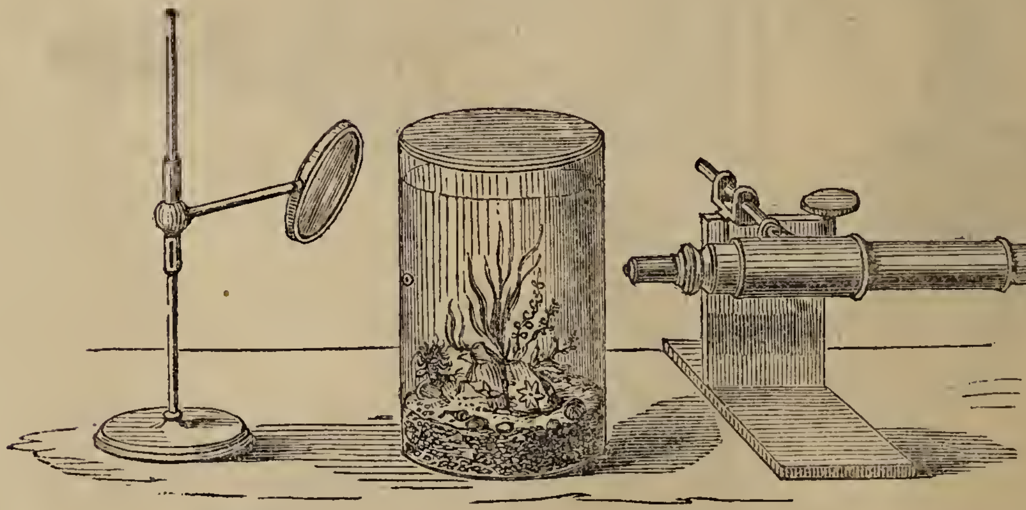


Fig. 83. Compound Microscope and stand, and one eye-piece, fixed for examining objects in a jar, £4. 4s., condenser 15s. For prices of jars, see page 94. For object-glasses see above.

Fig. 84.

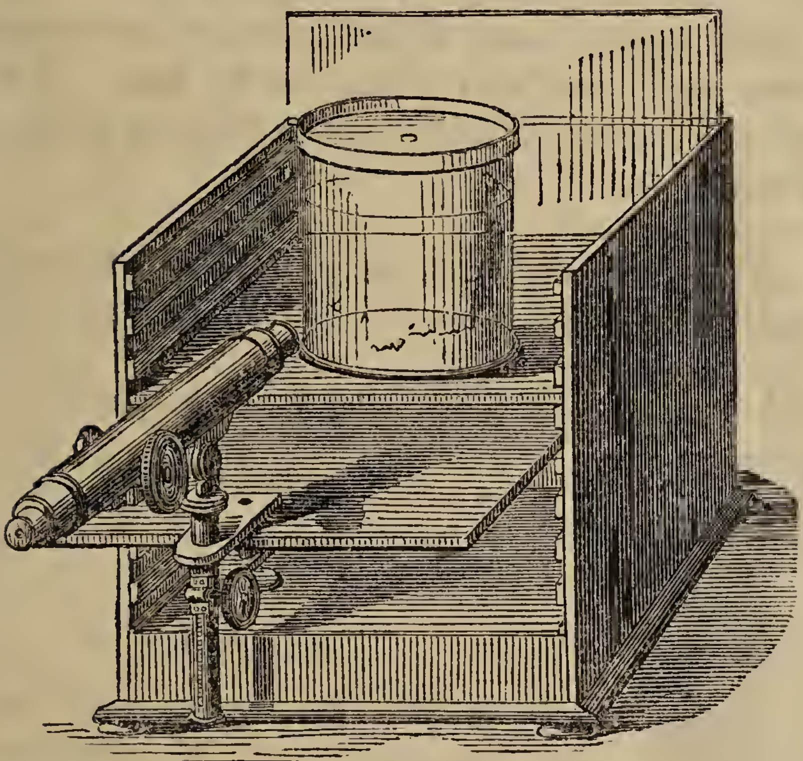


Fig. 84. Mahogany stand with two sliding pieces and plate-glass heat-screen, for examining objects in jars, £1. 8s.

Fig. 85.

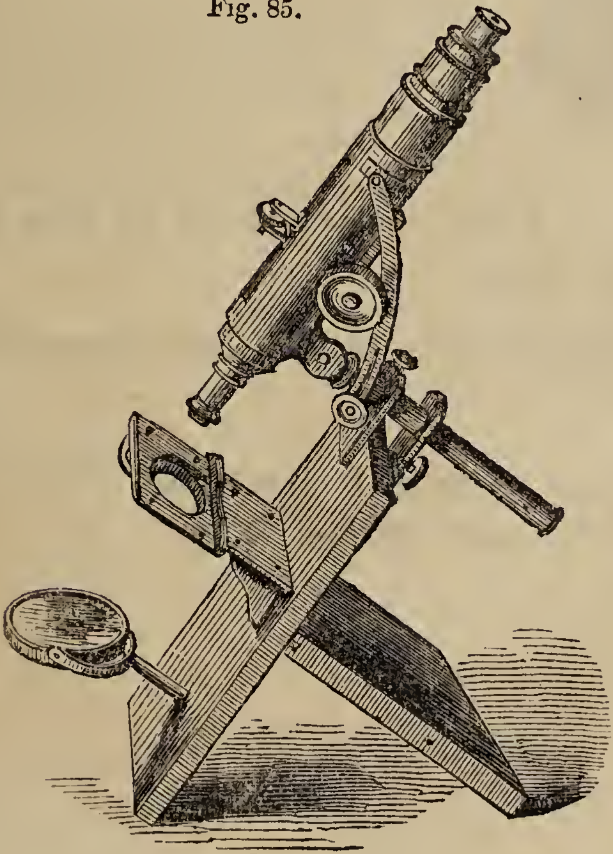


Fig. 85. The microscope represented in the preceding figures is here shewn, used as an ordinary instrument, with stage, mirror, and one eye piece, £6. 16s. For object glasses, see page 106. The instrument shewn in figs. 81, 84, and 85, is the same.

N.B. The clamp and the joints of this instrument enable it to be readily fixed to the base or to the table of a Tank.

Fig. 86.

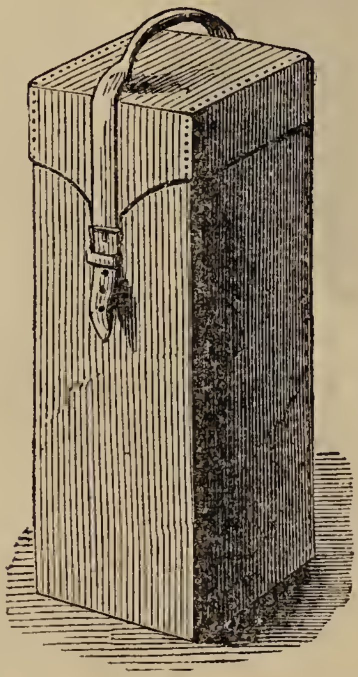


Fig. 86. Strong cow-hide leather case for this microscope. Measurement of case 12 inches long; 6 inches broad; 4½ inches deep, 21s,; or in gutta-percha, 12s. 6d.

Tissue paper of the proper shade of blue, for screening Aquaria, 1d. per sheet.

Prepared dried food for Marine and other animals, 2d., 4d., and 6d. per box.

Pump for the occasional circulation of the water in the patent slope-back Tanks, 5s. and 7s. 6d.

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>
> The Athenæum.

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⁂ Some of the Reptiles are Aquatic.

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BOCCIUS.—A Treatise on the management of Fish in Rivers and Streams, by Gottlieb Boccius, 8vo., 5s. 1848

* BUSK.—A Catalogue of the Marine Polyzoa in the British Museum, by Professor George Busk, numerous plates, 12mo., and 8vo. (In course of publication.)

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*HARVEY.—Harvey's Atlas of British Sea-Weeds : being a reproduction, on a smaller scale, of the whole of the preceding "Phycologia," 4to., in parts, 80 coloured plates, with the Synopsis (letter press) in a separate 12mo. volume, £3 5s. 6d. 1858

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⁂ The Aquarium is one of the "Adornments" treated of fully in this volume.

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⁂ The fresh-water division is in preparation.

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„ pumila
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„ ramosa
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„ obliqua
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„ dumosa
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„ volubilis
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Notamia bursaria
„ loriculata

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Cellularia scruposa
„ ternata
„ plumosa
„ avicularia
Carbasea bombycina. Foreign
Flustra chartacea
Flustra truncata
„ foliacea
„ carbasea
„ avicularis
„ Murrayana
„ membranacea
„ Algoa Bay
Caberea boryi. } Foreign
Menipea triseriata. }
Salicornaria fasciminoides
Vesicularia spinosa
Valkeria cuscuta
Membranipora pilosa
Seriataria lendigera

NOTICES OF THE PRESS.

From MR. GOSSE'S AQUARIUM, *2nd ed.*, *p.* 273.

"MR. LLOYD is constantly supplied with Marine Animals from the Kent, Dorset, South Devon, North Devon, and Welsh coasts, and occasionally from Cumberland and the Channel Islands; so that his stock in London possesses a variety not to be found in any single locality on our shores."

From MR. LEWES'S SEA SIDE STUDIES.

"THAT enterprising caterer for the wants of Naturalists and Amateurs, Mr. Lloyd."

From MR. SHIRLEY HIBBERD'S MARINE AQUARIUM, *p.* 48.

"I have my readers' interest only at heart when I suggest that no one should attempt to set up an Aquarium without first paying a visit to the establishment of Mr. W. ALFORD LLOYD, of Nos. 19 and 20, Portland Road, Regent's Park, where choice may be made from a stock consisting of *thousands* of specimens, supplied, as the oyster-shops say, 'fresh every day.' Mr. LLOYD was a labourer in the field years before the Aquarium became popular, and his experience, attained by patient study, is now at the service of all who need advice or assistance in *any* department of the subject."

From DR. LANKESTER'S AQUAVIVARIUM, *p.* 11.

'MR. W. ALFORD LLOYD, of London, who, by his enterprise in securing specimens for his beautiful collections, has done much to extend our knowledge of how to manage the Aquavivarium, as well as to create a taste for its adoption."

From MR. SOWERBY'S WATER VIVARIUM.

"IN the course of my preparations for this work, I have received valuable assistance from the zeal and experience of Mr. ALFORD LLOYD, of Portland Road, whose extensive collections have been in the most liberal manner placed at my disposal. That gentleman is in correspondence with collectors placed at various parts of our coasts, and is constantly receiving new specimens for the supply of private Tanks. Those who apply to Mr. LLOYD's establishment will receive information, which may be fully relied upon, respecting the mode of proceeding in the formation of Marine or Fresh-water Aquaria."

From THE LONDON QUARTERLY REVIEW, *April*, 1857.

"THE demand for Aquaria has created a new class of dealers in marine stores. Of these, Mr. W. A. LLOYD has taken the lead, and evidently means to keep it. His arrangements are on a grand scale. Of animal life alone, he professes to keep in stock fifteen thousand specimens, and yet such is the demand that the numbers are often reduced within very manageable limits; while the Algæ, which are of equal, and sometimes of greater importance, are not to be had for love or money. And truly the latter is not stinted in any case."

From MR. HOGG ON THE MICROSCOPE, 3*rd ed.*, *p.* 407.

" . . . . . Visit Mr. Lloyd in the Portland Road, Regent's Park, whose experience and large daily supplies, enable him to give satisfaction to all his patrons."

From MR. KINGSLEY'S GLAUCUS.

"ALL these and more, can be procured from my friend Mr. LLOYD, of the Portland Road."

From THE MORNING CHRONICLE, *June 4th*, 1857.

"IN the large conservatory* [of the Horticultural Society's Show at Chiswick] were placed some very elegant and admirably constructed Aquariums, exhibited by Mr. LLOYD, of Portland Road, Regent's Park, one of the best known and most deservedly celebrated among those who have brought to their present stage of perfection those instructive and entertaining ornaments of the drawing-room. We have never seen a finer collection of those beautiful sea-anemones than is contained in one of the Aquariums shown by Mr. LLOYD; and another was filled with a most varied and interesting collection of fresh-water fish and reptiles, including many of those curious black lizard-like creatures known as newts.

From TITAN, *October*, 1856.

"IF we pass from too zealous attempts at popularising the Aquarium, to those in which a knowledge of the scientific principles involved in their proper management is combined with more than a mere business interest in selling them, we shall find that the trade in these aquatic communities is altogether destitute of painful and disgusting associations, and highly curious and interesting. Any one that cares to see an establishment where this novel branch of industry is carried on on a large scale, and where every effort is made to imitate the natural conditions proper to each class of animals, could not do better than pay a visit to Mr. LLOYD, of Portland Road, Regent's Park, who deservedly stands first on the list (with a second nowhere) of those practically engaged in promoting the study of aquarian natural history. Although everything necessary for the formation of both Fresh-water and Marine Aquaria is kept in constant readiness, it is to the latter more especially that Mr. LLOYD directs his attention; and his stock of marine animals, numbering something like fourteen or fifteen thousand specimens, is interesting not only to amateurs, but to naturalists themselves. It is the result of an organized body of collectors posted at intervals in the richest localities along the coast, and affords a fair representation of that portion of our marine Fauna and Flora adapted to the purposes of the Aquarium. The motley host is accommodated in about fifty large plate-glass tanks, containing in all a little ocean of more than a thousand gallons of real sea-water.

"Once inside Mr. LLOYD'S doors, an imaginative man might fancy himself miles away from the dusty road and the cabstand outside, suddenly dropped down in some quiet nook by the sea-side. Imaginative or not, one is instantly greeted with the strong scent of the sea-breezes, and in the tanks around you see enough at a glance to be assured of the presence of numberless wonders of the shore. Let us look round for a minute or two. Notice here, in this shallow octagonal tank, how complacently a colony of juvenile crabs are picking their way over the shingly bottom, as though they were still at home on the Dorsetshire shore; and see, attached under that ledge, there is a little hairy broadclaw, first cousin to the shore crab, and a very pet for the Aquarium. An adjoining tank gives us an assortment of anemones, the primal favourites, as they well deserve to be, of 'the sea's abundant progeny.' And these are some of the choicest of the class :—*gemmacea*, with its pretty ringed arms, and *bellis*, with its looped fringes of tiny tentacles, stand up boldly, evidently courting our admiration; but a consequential *dianthus*, big enough to know better, has stuck himself against the vertical face of the tank, and only shows his tail. Look narrowly over the stones at the bottom, and you will be sure to see some young ones upstretched in imitation of their elders, like little stars of tinted jelly; while here and there a circle of tentacles peeps up from amongst the sand, betraying the whereabouts of some grubbing individual that delights in living underground. Another step, and we have before us some of the spiny-skinned fraternity —the prickly little *echinus* protruding its delicate worm-like suckers, as it crawls up the granite block; a pretty pink star-fish (*Uraster rubens*) similarly engaged; and, aërating himself at the top of the water, one of those preposterous *holothuria*, or sea-cucumbers— a sapient individual, which Mr. Lloyd declares to us, not long ago voluntarily disembowelled himself in a fit of spleen. The gentleman is only now in a convalescent state, and still looks remarkably pallid and wo-begone. Next in our way comes a tank with an army of perriwinkles at work upon the glass sides, mowing down a troublesome growth of *confervæ*, which gives us only an indistinct view of some members of the Wrasse family sporting within. Now we have a tank of artificial sea-water, clear as crystal, and with several *actiniæ* quite as much at home as in their natural element. Amongst the rest, there is here a beautiful *anguicoma*, standing proudly erect, and spreading out its delicate glassy tentacles—a very fairy of anemones.

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* A Conservatory is contrary to rule for Aquaria, see p. 57, but this was merely a temporary arrangement lasting a few hours.—W. A. L.

"But, really, there is no end to these anemones. Our next step confronts us with *Anthea cereus*, sitting perched upon a block of stone, waving to and fro its long snake-like arms; while, immediately below, *Bunodes crassicornis* stands up, huge in size, and arrayed in the gayest tints. Then, in a little cylinder above, carefully kept by himself, there is *Edwardsia vestita*, the curious worm-shaped anemone discovered by Edward Forbes, on the island of Paros, in the Ægean Sea, and which, until Mr. Lloyd's collectors turned him up on the coast of North Wales, was supposed to be an exceedingly rare species. The peculiarity of this anemone is, that it forms for itself a tough thick tube of condensed mucus, which it keeps half buried in the sand, and into which it withdraws itself at the slightest alarm. As we first look at the gentleman, he is protruding boldly from his tube, with his expanded disk of spotted tentacles broadly displayed; but a tap on the glass brings him down in an instant, and then all that you can see is a rounded ridge of sand, which the most sharp-eyed professor would be apt to overlook on the shore. Peering into another of these cylinders, we light upon a group of *serpulæ*, which, like sensible worms that they are, keep within doors during the heat of the day, so that we can catch only the tips of their brilliant plumes of pink and white. But in this glass Mr. Lloyd points out a little white speck on one of the tubes of the serpulæ, which we are told particularly to note. Doing our best, we can only just detect its presence by the naked eye, but on turning a microscope upon it, the tiny speck proves to be a minute hydraform polype of exquisite beauty, and which its owner expects will by-and-by turn out to be an embryo medusa in its early polype form. Cylinder number three presents us with a pair of water-spiders, and a whole aquatic brood of youngsters just escaping from the bag of eggs at the top of the water, the little fellows kicking and jerking like veritable water-fleas at their newly-achieved liberty; while cylinder number four charms us with the sight of half-a-dozen of the diminutive, gem-like, stony corals, which are the sole representatives on our own shores of the reef-building corals of the tropics.

"In another part we come upon a shoal of lively sticklebacks, rejoicing apparently in the possession of a cool corner; here there is a company of young eels, that have a glass to themselves, and glide gracefully amongst the blades of a *valisneria;* there a dish of the common anemones, huddled up into all sort of shapes, and of a dozen different colours, wait for a fresh allowance of water; and another step onwards we come to a stand before a combined Aquarium and Fern-case, ready stocked and of large size, 'a thing of beauty,' waiting to become a 'joy for ever' to any sensible person with only a few pounds to spare. At this point, we kick our toes against a huge slate tank, in which Mr. Lloyd keeps stored away numberless gallons of sea-water, which is brought every week from out of sight of land and sold across the counter at so much per gallon as regularly as London porter.

"In order to put the cap of completeness on his establishment, Mr. Lloyd not only has his stock of animals and plants, and tanks of all sorts to put them in, but on his tables you may see a very fair representation of the various etceteras the Aquarium has either appropriated or called into being. The list of books alone would be a formidable item, if all that he has to show were necessary to have; then there are specific gravity tests, and thermometers for regulating temperature, lenses and microscopes for viewing objects in the Aquarium, drip glasses and syringes for aëration, syphons for removing water without disturbance, and dipping tubes and spoons for getting rid of all matters that are offensive to the delicate sensibilities of the captive pets. We give a parting glance at the array of tanks, and wonder, as we take our leave, what various fates await the singular assortment of living things they contain.

"One of the oddest things in connection with this Aquarium trade is, the prodigious marketable value it has given to creatures and objects never before dreamed of as convertible into hard cash. And so it is all through the list of Aquarium requisites. The pond snails, *lymnea* and *planorbis*, sell at the rate of sixpence and a shilling the dozen; sticklebacks and minnows are equally valuable; while some of the larger water-beetles go to the tune of half-a-crown a pair! Our friends from the seaside, of course, are proportionately higher. Perriwinkles, for example, at a penny a-piece would seem dear at Billingsgate, no doubt, but in a marine Aquarium, their value is great, and price is not to be thought of. Shrimps and prawns again seem marvellously high at ninepence and a shilling, and yet Mr. Lloyd will tell you that he can't get enough of them. So again, with the little gobies and pipe-fish, that boys at the seaside dip up from the rock pools, or catch under stones when the tide goes out—they cost you as much as the finest mackerel.

"But, as a matter of course, it is for the sea-anemones that you pay prices the most extraordinary. *Mesembryanthemum*, becoming common everywhere, and found up to high-water mark, you may get from sixpence upwards; *crassicornis*, a monstrous fellow, but one that will probably die within a week after you get him, is yours for a shilling. But for a good specimen of *anguicoma, bellis, dianthus*, or *gemmacea*, you must put down at least three or four shillings; for the pretty strawberry anemone, nothing short of five shillings; and if you would own the new *Edwardsia*, the price mounts up to seven shillings. We might have greatly amplified this curious list of prices, but quite enough has been given to show that your Aquarium dealer is no pettifogging tradesman, and that his little people of the sea are having justice done to them in a monetary point of view, if in no other.*

"The reason of these extraordinary charges, as they certainly appear at first sight, is not far to seek, nor is it difficult to show that they are fair and reasonable when all things are considered. The inevitable risk, and the frequent casualties attendant on keeping such a miscellaneous live stock, necessarily add to the price of the creatures that are sold; and then the collectors have to get their living by catching the stock, before the dealer has them to get his living by their sale. The collector of objects for the Freshwater aquarium is most commonly a miserable object himself—a fit companion for the old familiar birdcatcher that we meet occasionally, toiling home, with his cages tied up in canvas at his back. You may see him any morning in summer, a few miles out of town, dipping up his newts and water-beetles from the roadside ditches, or dragging the ponds for fish; and if you see him again later in the day, and examine his can, you will probably find it filled with gasping crowds, the half of which will be dead before he can turn them over to the dealers in town. The collectors of marine animals are quite of another order, and are obliged to go to their work well booted and belted, equipped with basket and bottles, chisel, hammer, and crowbar; they need, too, to be quick of eye, and dexterous in the use of their tools. An amateur collector, down at the seaside for his autumn holiday, can afford to come home from a day's adventures amongst the rock and sand flats empty-handed, but the man who makes collecting his business must fill his jars and bottles at every ebb of the tide.

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* The prices here named were exaggerations even at the time the above extract was written, but since then, the introduction of machinery, and of other facilities and appliances, and of a better system generally, have very much reduced the cost of articles in every department.—W. A. L.

"No less than fourteen of these collectors by trade are constantly on the look-out to keep Mr. Lloyd's tanks supplied with stock; and from Dover round the entire south and west coast to Solway Frith, there is no important locality that does not contribute to his store. In the journey from the coast to London, the casualties that occur are sometimes rather serious. A long hot ride, even though it be by express train, is by no means conducive to the well-being of little fellows accustomed to the open shore and the bright sunshine. In such cases, it sometimes happens that the shrimps and prawns lose their ghostly pallor, and present themselves with their tails folded in, in their familiar guise of pink or brown; the anemones look like whelks cooked for sale in the London streets; your crabs come out red; and what fish there may be at once float with their bellies upwards. All this, of course, considerably enhances the cost of a large stock."

HAYMAN BROTHERS, PRINTERS, 13, GOUGH SQUARE, LONDON, E.C.

BLANK PAGES FOR MANUSCRIPT OR OTHER ADDITIONS.

Since pages 19 to 22 and 37 to 38 have gone to press, it has been found advisable to circumscribe still further the number of forms of vegetation desirable for Aquaria, whether marine or fresh-water, and in explanation of this, a short and plain printed paper, stating some general principles connected with the culture of Aquatic plants, will be sent with every supply.

THE FOLLOWING PRINTED FORM,

intended for the guidance of purchasers in the selection of Aquaria, is requested to be filled up, torn out, and returned to Mr. Lloyd, that he may advise accordingly. A rough plan, showing the position of windows and the direction of the sun upon them, as variously influenced, is desirable. See paragraph 9, page 13.

	ANSWERS.
1. In what *kind* of apartment or other place is the Tank to be put?	
2. How is the apartment *lighted* by windows?	
Are the windows in the ceiling (*i. e.* a sky-light) or in the wall?	
Are there windows in the opposite walls?	
Are there windows in any two walls placed at right angles to each other?	
3. Supposing that it is intended to place the Tank near a window in the wall, what is the *aspect* of the window? Is it east, west, north or south, or what combination of those directions?	
4. At what *distance*, in feet or inches, would it be convenient to have the Tank stand away from the window?	

ANSWERS.

5. What is the *temperature* of the apartment at the time of this form being filled up, reckoning by a thermometer placed in a shaded spot, in the warmest part of the day, and removed from any direct influence of the immediate source of heat?

Is a fire maintained in the apartment or place in winter?

If so, at what distance is the fire from the spot the Tank is to stand on?

6. What amount of *space*, in feet or inches, can be allotted to the Tank?

7. What is the Tank to be *supported* upon?

8. Is the Aquarium to be *Marine* or *Fresh-water?*

9. What *kind* of stock is intended to be kept, general or particular?

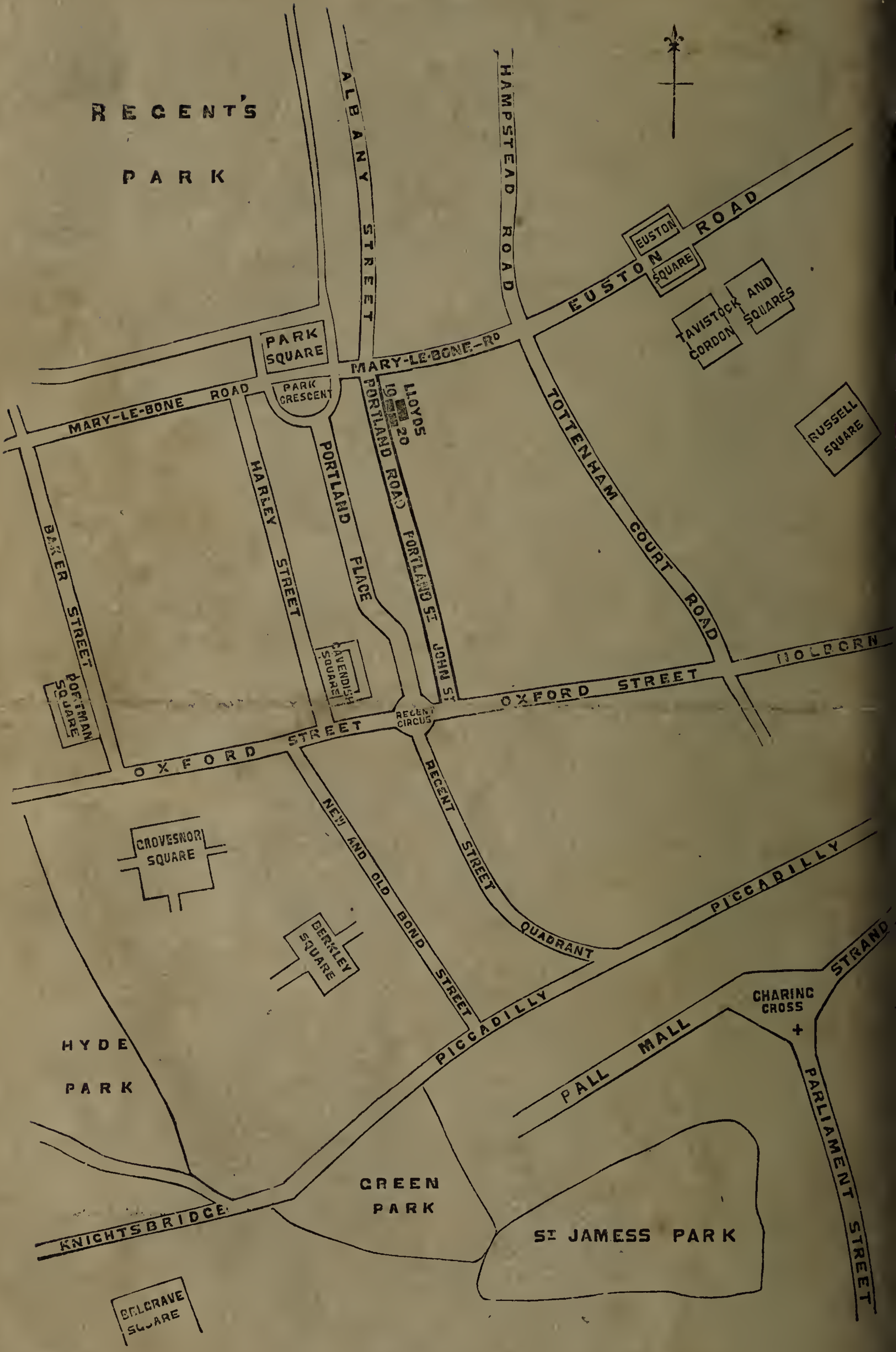
10. Name.

11. Address.

12. Date.

13. Stamp for Reply. . . . .

As there are two or three Portland Roads in London, the map overleaf gives the relative position of *Portland Road, Regent's Park.* It is a continuation of Great Portland Street (formerly John Street), near Regent Circus, and runs parallel to Portland Place from Oxford Street to Marylebone Road (formerly New Road), near to Trinity Church, close to the south-east lodge of Regent's Park. It is central to Belgrave, Portman, Cavendish, Berkeley, Russell, and Euston Squares; to all the Parks, and to the principal west-end thoroughfares.



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EUSTON ROAD
EUSTON SQUARE
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RUSSELL SQUARE
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MARY-LE-BONE-Rº
MARY-LE-BONE ROAD
PARK CRESCENT
LLOYDS
19
20
PORTLAND ROAD
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1860.

ENTERED AT STATIONERS' HALL.

In August, 1858, was issued "*A List, with Descriptions, Illustrations, and Prices, of whatever relates to Aquaria,*" post 8vo., 1s., or by post, 1s. 2d. This publication was put forward merely as a tradesman's annotated catalogue, and therefore with none of the commercial advantages which usually attend works regularly presented to readers by the bookselling trade. Yet it was speedily found that its pages contained so much information of a perfectly original kind, both printed and engraved, that it was well spoken of,* and gradually came to be regarded as a little volume of instructions on the subject. It attained a large and steady sale, which is still going on, and the recognition of the principles laid down in it has caused an almost total change in the views formerly adopted with respect to the domestication of aquatic plants and animals—whether marine or fresh-water.

Since the period named, further improvements have been made in every department; and one of the aims of these has been to produce such a modification as would permit GREAT EFFICIENCY, CHEAPNESS, AND EXTERNAL NEATNESS to be joined together in one Tank, in a manner not before thought of. THIS LONG REQUIRED FEATURE HAS AT LENGTH BEEN ATTAINED, and to a description of it, and to a further elucidation of principles, this Supplement is chiefly devoted. The instructions now given will, it is believed, very largely extend the pursuit, especially as ECONOMY is made an essential point, and they will enable any person, in any remote or inland place, to set up and successfully manage a marine Aquarium, even if one has never been seen before, and without the necessity of more than the first limited supply of unchanged sea-water.

Purchasers of Tanks are reminded that they may always obtain written instructions to suit particular circumstances, or to clear up any difficulties which these two pamphlets do not refer to. Such instructions are given without any charge, *but applications for assistance should be always accompanied by the return of the printed form inserted at page* 127 *of the* "*List,*" properly filled-up, and by the naming of as many other particulars as may suggest themselves.

Two stamps must be enclosed in letters requiring answers.

W. Alford Lloyd.

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* See pages 3 and 4 of this wrapper.

RB64822

A Supplement to a List of whatever relates to Aquaria; containing Practical Instructions for their Management. By W. ALFORD LLOYD, 19, 20, and 20a, Portland Road, Regent's Park, London.

"ALTHOUGH this is but a pamphlet, or rather part of a pamphlet, it is, on its own particular subject, a perfectly invaluable sixpenny-worth. *Many manuals have been published upon Aquaria, but we confess we have seen nothing for practical utility like this.* Mr. W. Alford Lloyd has devoted so many years of his life, and evidently so much of his heart into the bargain, to the management and construction of Aquaria, that he *must* be worth listening to, and his success is becoming so universally acknowledged that the French Imperial Society for Acclimatation of Animals, at Paris, has intrusted him with the erection of some Aquaria they are resolved to establish, 'worthy of a public body, and of the French nation.'

"We do not speak ignorantly when we assert that Mr. Lloyd's observations on the different discriptions of tanks, and the growth of plants, and preservation of animals in them, are deserving the careful attention of all who wish to have the pleasure of these interesting ornaments in their houses.

"The disgraceful mismanagement which is so constantly to be seen not only among amateur *aquarianists* but in the public tanks erected at a great expense in museums and botanical gardens, is most discreditable not only to the skill but the humanity of those concerned in the keeping of them. Mr. Lloyd alluded forcibly to this in a letter which appeared in the *Athenæum*, December 10th, 1859, of which a copy is now given at page 159 of this pamphlet. He instanced the blunders committed not only in the Zoological Gardens, but at the Crystal Palace, Sydenham, and in the Public Museums of Scarborough, Weymouth, Dublin, Edinburgh, Hull, &c.,; and of the truth of what he says, in three of these cases we have ourselves been a regretful eye-witness, and he might have added York to the list, for there literally, after a few years' obstinate blundering, the whole affair has come to an end, and the twenty guinea tanks lies now a dry empty monument of the ignorance and recklessness of its managers.

"We are pleading the causes of humanity in pleading for a better spirit in those who undertake the care of these poor animals. No one has a right to use them as the fashionable toy of a few weeks' amusement, and then leave them to perish by miserable torture or idle neglect. We wonder at nothing where fashion leads the way; but the delicate ladies who set up an Aquarium, should bear in mind that they know very little of the life they are tampering with; and though sea anemones dying by slow degrees in a foul untended bowl, create no noisy horror like a bull-fight, there is a peculiar enormity in the silence with which those murders are done, and the indifference with which they are viewed.

"From all such cruelties, the disciples of Mr. Alford Lloyd will be effectually preserved, by perusing and carefully following the directions contained in this pamphlet. There is also in it a list of tanks and prices, and the first part, to which this practical one is a supplement, gives particulars of every thing necessary for the stocking, &c., of the vessels used.

"We most cordially recommend both Mr. Lloyd and his pamphlet to every one really desirous of setting up one of these beautiful household ornaments."—*The Era*, October 14th, 1860.

"A VALUABLE addition to the work we commended not long since, which every keeper of an Aquarium should at once possess. Mr. Lloyd has done his part to revolutionize the economy of the Aquarium, and herein is a summary of the results as applied to practice."—*Recreative Science*, November, 1860.

The Tanks named at page 148 are now kept in stock ready built-up with rock-work, and with the vegetation grown so as to be fit for the immediate introduction of animals without further waiting or trouble. These can be sent safely to any part of London or its vicinity.

OCTOBER 18TH, 1860.

[OVER.

A SUPPLEMENT

TO

"A LIST, WITH DESCRIPTIONS, ILLUSTRATIONS, AND PRICES, OF WHATEVER RELATES TO AQUARIA,"

CONTAINING :—

1. A description, with sizes, prices, and eight engravings, of a series of patent Tanks equally effective for service as those referred to at pages 49—50, and 60 to 65 of the "List," but which are cheaper, because of the adoption of different proportions.
2. A description, with three engravings, of a mode of placing large Aquaria externally to houses, so as to occupy no space within them, but yet so as to be visible from the inside.
3. A description and an engraving of a form of Tank termed "composite."
4. A description, with an engraving, of an arrangement by which many varieties as well as large numbers of marine animals may be maintained in such manner, that while creatures of different habits are kept separated from each other, a very large quantity of oxygen, with motion of the water, and with a tidal action, is also furnished to them.

1. Economy is obtained in the series of Tanks now offered for sale (marked A to H, page 148); not by the use of inferior articles, but systematically, and by reference to the law that *the value of water for Aquarian purposes does not, within certain limits, depend so much upon the bulk of it, as upon the advantageous distribution of that bulk over large spaces.* Water is merely a vehicle for holding in suspension, or a medium for dissolving, the quantity of oxygen necessary for the breathing of certain animals; and this oxygen is absorbed from the surrounding atmospheric air exactly in proportion to the extent of water-surface in contact with that air, the water being in a state of freedom from agitation, as it is in all ordinary Aquaria. The three following diagrams, A, B, C, (figs. 87, 88, and 89,) represent three vessels (supposed to be Tanks for plants and animals) of equal water-capacity, but of unequal aërating or oxygenating capacity. The contents of each being 1000 cubic inches, the depth from the dotted water-line is in A 5 inches, in B 10 inches, and in C 20 inches. The measurement of surface of water in contact with air in A is 200 square inches, while in B it is only 100 square inches, and in C it is but 50 square inches. Therefore, according to the rule just laid down, the quantity of oxygen absorbed by the water from the air would be in A twice as much as in B, and four times as much as in C, in the same space of time, at equal temperatures, and in equal conditions of quiescence. The air touches only the *surface* of the water, and it pervades the whole mass of fluid downwards perfectly or imperfectly in proportion as the mass is thin or or thick, as in any other mechanical process. Putting the statement in another form, if A would accommodate and permanently provide aëration

Fig. 87.

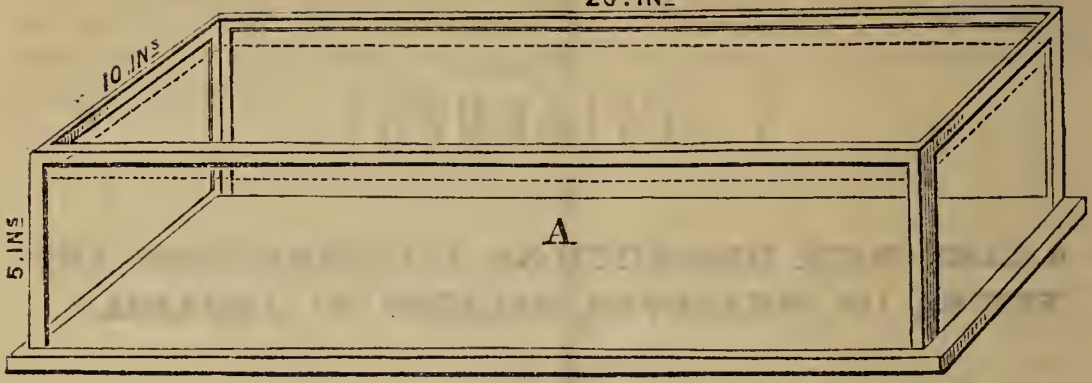


Fig. 88.

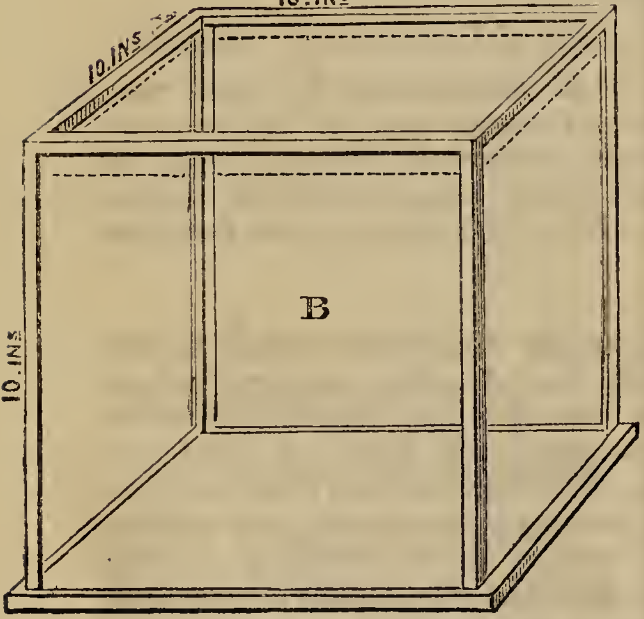
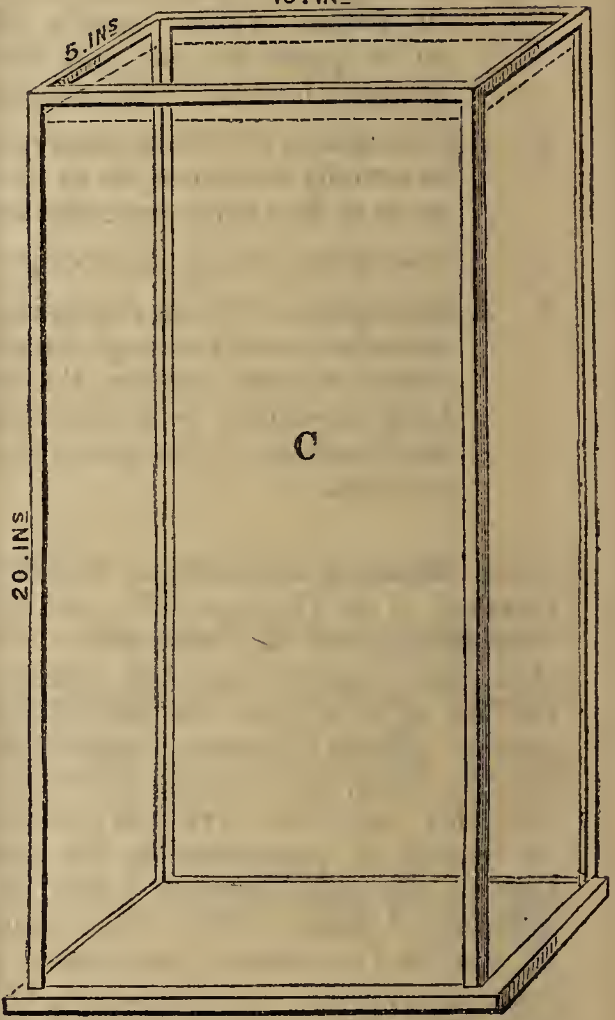


Fig. 89.



for twenty animals, then B would sustain only ten animals, and C would maintain but five animals, the health, the kinds, and the sizes of the creatures being equal, and the temperature and all other conditions being also alike. Yet the expense of the vessels would be the same; or rather the cost of B or C would be more than that of A, because of the increased strength required to sustain the greater pressure consequent on the greater height of water. If, on the other hand, A, retaining the present dimensions of the base, were made as high as C, the expense of it would be greatly increased, and yet its capability for maintaining animals would *not* be increased in anything like the same ratio, because the surface exposure of water to air would remain the same as before. Therefore, economy attained *in this manner*, by diminishing the size and the expense of the vessel containing it, although the quantity of water be reduced, does not necessarily imply loss of aërating power or corresponding diminution of the number of animals which may be kept.

In other words, the Tanks now introduced enable the greatest number of animals to be healthily maintained in the smallest space, and therefore at the least expense; and yet without any poverty of appearance, either in the vessels themselves, or in the relation between their size and the number of creatures they will accommodate; for the water in them being not uselessly *piled-up*, but well *spread-out* and advantageously distributed, every portion of it is turned to useful account as a means of administering oxygen.

These Tanks are mainly intended for the keeping of sea-anemones, corals, (madrepores), starfishes, sea-urchins, sea-cucumbers, serpulæ, sabellæ, crustacea, mollusks, and other marine animals of suitable kinds, sizes, and dispositions, the majority of which have but slow locomotion, or are wholly fixed, and thus not being able, or not having the instinct, to travel up to the surface of the water for air, according to their wants, are found to live best in confinement when the surface of the water and the air in contact with it are (so to speak) *brought down to them*. In fact, these animals, though truly aquatic, are killed by being *drowned** in deep vessels of imperfectly oxygenated water, though more slowly, yet quite as effectually as terrestrial creatures would be drowned if confined below the surface of water, death by suffocation resulting in both instances. This being understood, it is evident that the ten animals of these kinds allotted to diagram B, or the five adjudged to diagram C, remaining, as they would, congregated at the bottom, would make a very insignificant show, because the upper half of B, and the upper three-fourths of C, would represent an amount of space and money idly spent. No satisfaction is felt in a large Tank with but few animals in it; and yet the possessor of a great and deep Tank, mistaking its large *water-capacity* for an equivalent *oxygenating-capacity*, and introducing a correspondingly large number of animals, obtains but a small measure of success. Some of the creatures under such circumstances die at once; but others of the hardier kinds, such as anemones, may remain in a state of lingering existence for a long time, losing colour and beauty, and gradually dwindling in size and becoming starved, not perhaps from the lack of an endeavour to feed them, but because, suffering from the general want of oxygen, they have not the *power* to eat, and at last die from inanition caused by ill-ventilation.

The special adaptation of these Tanks for *marine* animals is mentioned, not because they are wholly unfit for fresh-water creatures, but, as the interest of the latter must ever consist chiefly in *fishes*, on account of the absence in fresh-water of radiate* animals of sufficient size for popular Aquarian purposes; and as fishes are of actively moving habits, they require greater space and more oxygen than can be afforded them in small Aquaria, unless those which are kept are so few and minute as to raise the question of their being sufficiently interesting to repay their cost of accommodation at all. Therefore it is becoming felt that what the available fresh-water animals lack in curiosity of form and in unfamiliarity of habits, must be compensated for, in Aquaria devoted to them, by *ample dimensions*, in the specimens, in the Tank itself, and in the large and bold formation of the stone-work of the interior. But these essentials are not always attainable; and hence, of late years, fresh-water Aquaria have come to be much disused, and sea-water collections have gained the ascendancy, not merely because sea-animals are uncommon in character, and handsome in colour, but because they (most sea-fishes and crustacea excepted) are easy to manage in limited spaces, much more so than fresh-water animals. Accordingly, fresh-water Aquaria on a small scale are seldom effective. Moreover, objects for fresh-water Tanks are very expensive and hazardous in carriage, on any but the shortest journeys, while marine specimens are easily and cheaply transported, as they mostly do not require to be sent in water, which is heavy, but merely in a moist state. Some improvements have lately been made in the manner of packing marine animals by enclosing them in substances which retain moisture without being subject to the decomposition attendant on the former use of damp sea-weeds for this purpose, and they are further protected by being placed in cellular boxes. This mode, while it prevents crushing and injury by shaking from side to side in the boxes, yet allows of a certain amount of ventilation, and, as a written list of contents is also enclosed, with the number of each cell marked against the corresponding specimen or specimens, some help to identification of species is thus given.

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* Many years before Aquaria became popular, the late Dr. Ball, of Dublin, found by experience the value of shallowness as a means of oxygenation for aquatic animals in confinement. This is evidenced by the following statement, in his own words:—"I once had a domesticated cray-fish (*Astacus fluviatilis*), which I kept *in water not more than an inch and a half deep, previous experiments having shewn that in deeper water, from want of sufficient aëration, this animal would not live long.* * * * * * * He lived in all about two years. * * * * * * The water was never changed, but some was occasionally added to supply the loss by evaporation."

Mr. Ball afterwards records that his cray-fish was killed by accident.

Every one who has observed the habits of hermit-crabs in confinement, will have noticed that they climb up to the highest points in the vessel in which they are kept, so as to get close to the surface. Star-fishes, sea-cucumbers, limpets, periwinkles, the common smooth sea-anemone, and many other creatures, are also fond of creeping-up to the water's edge in Aquaria. These instincts point out that, while water is necessary for the animals, *to keep them wet*, the air they thus continually, and often vainly seek (in Aquaria), is essential *to keep them alive*.

The probable reason why sea-anemones, madrepores, serpulæ, and some other creatures of similar habits, are peculiarly well adapted for living in small Aquaria, is, because, not having any active locomotion to perform, they are satisfied with but a small quantity of water, so long as that small quantity is well aërated and pure. Of this, an instance is afforded by a madrepore (*Balanophyllea regia*, see p. 25), measuring one-eighth of an inch in diameter when closed, and one-third of an inch in diameter when expanded, which is now living in only 100 grains (half a dessert spoonful) of unchanged sea-water, tightly corked up, with a little vegetation, in a tube of the size of fig. 92, p. 135, and suspended at an eastern window of ground glass. In this small space it not merely exists, but grows and thrives vigorously, although it is in its eighth month of imprisonment. A small fish, or a young prawn, or even a minute mollusk or echinoderm, would not be likely to live under such circumstances, not because of any want of purity in the water, but because their entire structure and habits are opposed to confinement in such a narrow compass.

The structural principle adopted in these cheaper Tanks is the patent one of the sloping-back, with a dark water-chamber below it, as shown in section by fig. 6, page 49, the chamber in the new Tanks being made relatively less in size than it is there represented. The aim is to keep the area of the base as large as the cost permits, and to economize by diminishing the height without lessening the oxygenation. The workmanship and the materials are of the best description; and all recent improvements are made use of to secure a neat and light external appearance. There are no portions which can corrode—slate and glass being the substances used,—and every Tank is guaranteed to be perfectly and permanently sound. In some instances, when the distance is not too great for safety, the rock-work is sent in these Tanks ready fixed-in and seasoned, fit for immediate use.

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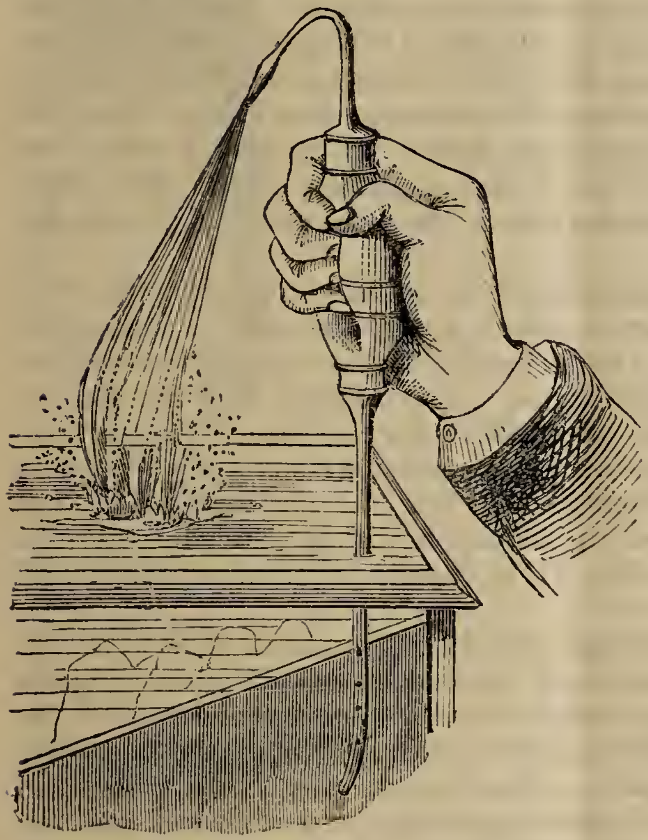
* Nearly the only fresh-water representative of anemones, corals, and other marine zoophytes, is the *Hydra*, which is of microscopic size and of dull colour; and there are no starfishes, urchins, cucumbers, or ascidians whatever in fresh-water. The fresh-water crustacean animal, of suitable dimensions, is confined to but one solitary species—the river cray-fish—while the mollusks are of no very great interest. Aquatic insects are indeed almost the only creatures which are used in fresh-water Aquaria, and which are not represented in marine collections.

Fig. 90.



Price 21s. complete in Case.

As this supplement is issued in August, 1860, the opportunity is taken to state, that the "dark-chamber" principle having had a fair trial for more than two years, has very far exceeded the good expectations formed of it at first. When it is remembered that an Aquarium consists of but a limited and unchanged portion of water containing growing vegetable and animal organisms, which in proportionate numbers much exceed those found in any corresponding bulk of water met with in an actual ocean, and that these organisms are constantly giving off excrementitious and decaying matters, the extreme value will be felt of having a counteracting appliance, and of possessing (within the Aquarium itself, occupying no space otherwise desirable, and not adding to the expense) a chamber or reservoir into which animals, plants, and their decaying results cannot enter, but which contains water in a state of *darkness*, and *clearness*, and which is always ready to be brought into useful action, and is ever purifying, by its freshness of condition, the portion of fluid in front, the latter constantly needing such help. *This arrangement is indeed next best to the having of a constant stream in an Aquarium.* The circulation between the two portions is found to be constant, though slow; but in the Tanks A to H it may be made more rapid, when required, by giving about a dozen strokes with a syringe (fig. 68, p. 97), its point being inserted in an orifice left for that purpose in the top left-hand corner of the slope, and the hole being closed after the operation by a loose bit of stone.* To say that this invention has largely helped entirely to revolutionize Aquarian science in the short space of about two years, is to tell simply the truth. Those who have used the dark-chambered Tanks, have never found any necessity to change the sea-water from the existence of the evils to remedy which this contrivance was invented.

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* In the other Tanks, Nos. 1 to 15, the exchange of water between the dark and the front chambers is managed by a pump (shown in the fig. 90), the water being lifted up and forced out by the alternate employment of the pressure of the fingers upon an elastic hollow vessel of vulcanized india-rubber, being fitted with a pair of metallic valves, silver-plated to prevent any corrosive action of the sea-water.

A less violent but nearly constant stream can now be given to Tanks 1 to 15, see pages 153 to 156, and 161 and 162.

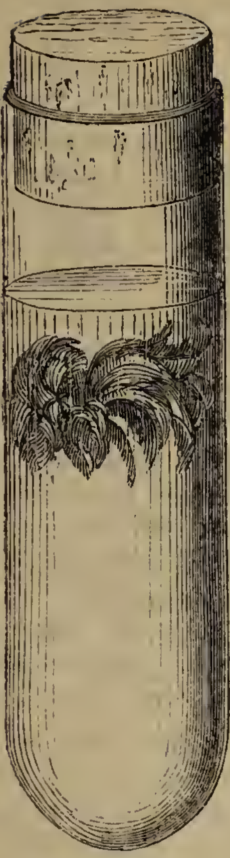
These cheaper Tanks (A to H), however, are not intended to supersede the other series of patent sloping-back dark-chambered Tanks, of the proportions named at pages 49 and 50, and 60 to 65, figs. 6, 8, and 16 to 21 (marked Nos. 1 to 15), as the latter, in addition to their now well-tried and ascertained merits in sustaining animal life by giving gradations of shallowness, and otherwise, permit also, by their increased height, that which will always be a desideratum in Aquaria, namely, a view of a picturesque arrangement of rock-work as seen from the front; and thus the object aimed at and attained in *them*, is not simply and only to utilize all the water for the purposes of the animals, but *to obtain scenic effect as well* as the good condition of a proper number of creatures. It is evident that *both* these purposes could not be attained in Tanks the prices of which are so low as are those of the present series, and, therefore, of the two conditions named, the one chosen is that which is the most essential for the life of the animals.

For example: Tank G, containing about five gallons of water, and costing £2 5s., will accommodate the same number, kinds, and sizes of animals as may be maintained in Tank No. 11, (page 62,) containing thirteen gallons of water, and costing £4 15s. Therefore, the purchaser of Tank No. 11 pays £2 10s. more than the buyer of Tank G, for the sake of the picture-like effect which may be obtained by it, and which may be rightly valued by some as much as the animals themselves, while the possessor of G, not caring for this effect, or not desiring to pay for it, is enabled to do the same amount of actual work as No. 11 is capable of, and at about half the price.

In Tanks A to H, therefore, though they do contain rock-work in a well-disposed manner, and though one side is of glass to enable minute objects to be examined through it, the principal view of the contents is from the top, after the fashion that objects are looked at in the drawers of a cabinet or in the table case of a museum: a convenient view is thus obtained at one glance. The admission of light is perfectly under control, and the weight of the whole Aquarium, even when filled, is not such as to prevent an easy change of position when necessary for seasonal requirements.

Economy, convenience, and propriety, are now better attended-to in the item of *vegetation*, both in these and in all other Tanks. The plants formerly deemed necessary for the furnishing of oxygen and for the decomposition of carbonic acid gas, were considerable in cost and troublesome in management. If marine, they were once required to be sought for in the form of *Ulva*, or *Enteromorpha*, or other green kinds, obtained attached to stones and in a growing condition. If fresh-water, it was supposed to be necessary to employ shrub-like flowering plants (*Anacharis*, *Myriophyllum*, *Stratiotes*, and the like) with roots attached. This system however, whether applied to marine or to fresh-water Aquaria, is found to be not merely useless and tiresome, but directly injurious; because the conditions which such plants demand are not consistent with the general well-being of ordinary Aquaria. The plan now successfully followed is that of introducing only the elements of the future vegetation (of a desirable kind and known to be well adapted for the purpose), but not the *bulk* of it. Accordingly, all that is now done is to put into a newly set-up Tank (of any

Fig. 92.



Actual size, price 1s., or enclosed in a tin box, free by post, for 18 stamps. The water is drained off, and the cork replaced before sending out.—See also p. 19, foot-note.

kind or shape, whether sea or fresh-water) a small quantity of *Algæ* sent in a tube (see figure 92), and to allow the propagation of this to depend on the amount of *light* afterwards admitted. The growth will be *sure* to come if sufficient light and time be given; and it is quite sufficient for the purposes required even when it is at such an early and minute stage as to be only recognised by the unassisted eye as a slight green colouring matter, covering the stonework, and feeling a little slippery under the finger. In this manner, and in this manner *only*, can be obtained with certainty the vegetation which is of real service in Aquaria. The plants at first produced are very humble in organization, and they are as inconceivably small in individual dimensions as they are enormous in number; but they possess withal the very essential character of being *indigenous to the Aquarium itself*, and of being active in the production of oxygen. This first vegetation is followed by other kinds, composed of masses of filaments more or less dense, long or short, and usually of bright green colours, or sometimes of a velvety texture and purple hue; but their kind and quantity, and even the order in which various species succeed each other, though in some measure influenced by the season of the year, mainly depends upon the amount of light admitted. Whenever, from excess of light, these vegetations grow too fast, they may be diminished *by reversing the means which produced them*—that is, by lessening the amount of light admitted, never, however, wholly excluding it. By thus attending to illumination, the growth may be maintained in any required state,—never too much, and never too little, but always healthy. It should be kept at a minimum rather than at a maximum amount, since it is evident that the less there is of it, compatible with the health of the animals, the less there will be to decay when the time of decay comes, these forms of vegetation being annual. Choice of aspect is of great importance during the spring, summer, and autumn months (see table, page 59). What is wanted is neither bright hot *sunlight*, nor yet such much-obscured daylight as is obtained, for instance, in corners and sides of apartments, but *direct cool day-light in moderation*, as found, for example, close to windows having a northern or north-eastern out-look. If in very fine bright weather there should in such situations be still found too much light, and more vegetation than is required, the glass cover of the Tank may be partially or wholly covered for an hour or two in the middle of the day by blue paper of the proper tint (see page 108). The rule is, to choose such a situation as will, when occasionally required, command light enough (free from sunlight in summer) to cause the evolution of oxygen, in visible bubbles, from the vegetation, but which yet permits that light to be lessened when not wanted. *Blinds* are very desirable for regulating the light.

As the foregoing statement is so entirely opposed to the directions laid down in most of the books on Aquaria, it is necessary to give some explanations on the matter, and to suggest the probable reasons which cause the failure of the old system of vegetating Aquaria. British pond plants, in a state of nature, exist under conditions of alterations of temperature and depth, and of quality and quantity of soil, which of course are *not matters of chance*, but are *absolute requirements* for the existence of the plants. The inactivity of winter is not merely a time of cold, but a season of repose incidental to the cold, and the soil is a source of food. Therefore, as they cannot get these conditions in the higher temperature and scantier soil (as compared with a real pond or river) of an in-door Aquarium, they die from the combined effects of *want of rest and of insufficient nourishment;* and this they do, either at once, or soon after a short and sickly period of forced existence.* The same general remarks apply to most of the green sea-weeds hitherto recommended for Tank purposes, in books, for if in the actual sea they get tides, and thereby periodical exposures to wind, rain, sunshine, and motion; those conditions are *not accidents*, but are essential to their well-being, and being deprived of them, as they must be in all ordinary Aquaria, they cannot and they do not live. And yet, nowhere do some sea-weeds grow more luxuriantly than in tide-pools, where they are *never* exposed to air. So that they appear to require some other conditions which at present are only supplied to them in a state of nature, and which no known Tank can imitate.

But as certain other plants *are* found to come spontaneously, both in sea-water and in fresh-water; and to flourish in Aquaria, either when grown from invisible germs, or by being propagated (see fig. 92); the very fact of their coming and existing proves that *they* at least, have met with suitable conditions; for if those conditions were not fitted and ready prepared for them, the plants would never be seen. Yet instances do occur, though rarely, of the appearance of Ulva and other marine plants, and of Hydrocharis and some few other higher fresh-water forms, in a spontaneous manner, in Aquaria. Of course there can be nothing to object to in such growths: on the contrary, it is much to be regretted that these instances are accidental, and that the present state of knowledge does not permit these results to be attained with *certainty*. Instances are also known of copious spontaneous growths of the beautiful *Bryopsis plumosa*, but when attempts have been made to transplant it into other Aquaria, under circumstances *apparently* similar, no success has been attained, so much is every Aquarium guided by its own local influences. These chances are but occasional, and are not to be calculated upon, and therefore the one great rule to be observed is, that the only vegetation which is of appreciable service to keep Aquaria in good order, is that which comes spontaneously, by the exposure of water to a certain amount of light.† The necessity of vegetation both as a means of furnishing oxygen—and as a mode of supplying food, in the first place by supporting the lives of myriads of infusorial animals, which serve as food for other creatures, these in their turn being consumed by other animals of higher grade—is so great and incessant, that its natural appearance, unbidden except by the action of light, air, and moisture, is a determinate law of nature acting in perfect independence of any artificial aid; and thus, as this universal disposition to vegetate is always at work in the hours of daylight, there is no known instance of a lack of growth of useful plants in any Aquarium which has been for a certain length of time exposed to a certain amount of light. If plants of wrong kinds have been first introduced, these have died, and others, furnished by the unerring hand of nature as being more fit for the purpose (without any care from the owner of the Tank) have succeeded them.* Indeed the complaint is, that in most seasons of the year, summer especially, *sufficient* vegetation cannot be obtained without getting *too much* of it, and hence the necessity for qualifying the light by the avoidance of the use of Aquaria having all their sides of glass; for the adoption of such a contrivance as a dark chamber; and for the choice of windows into which only day-light and not sunshine is admitted. At certain seasons a visible growth of vegetation from germs not previously visible has appeared in closely-stoppered glass bottles after only forty hours' exposure to daylight in a north-eastern window, and on the fourth day of exposure the plants have grown in such quantities that "millions" may be used as safely as "thousands" to express their number, so densely have they crowded the sides and bottoms of the vessels; and by the end of a week the whole mass of water has become of a semi-opaque green colour from the presence of innumerable locomotive plants, and of course all observation of the interior has been prevented. It is not *always* that there occurs this discolouration of the entire body of water in an Aquarium, but the excessive growth of plants of a minute filamentous kind (*confervæ*) does invariably follow an excessive admission of light under all circumstances; and whenever, in an Aquarium, such an overgrowth is permitted as will cause the appearance of whole forests of this conferva, and of a mass of froth on the surface of the water, in the course of a few days or weeks, the death of a great portion of the plants is a necessary consequence soon afterwards, either because there is too great a number of them within a limited space, or else they die from some change of season, or from a change in the position of the Tank, or because the light and temperature have been in some other way decreased or altered. The death of these minute plants and the presence of their remains in the Aquarium, under circumstances not implying a *total* exclusion of the light, do not necessarily produce the same degree of ill-consequence that the presence of decaying animal substances occasions;

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* Vallisneria spiralis *does* often flourish in Tanks, because, being a native of Southern Europe, it will bear the forcing of an Aquarium. Yet even it often fails from some not easily traceable causes, and the oxygen proceeding from minute plants parasitically covering its leaves, is frequently mistaken for that from the vallisneria itself.

† The recent experiments of Mons. Pouchet of Rouen, on so-called "spontaneous generation," simply prove how difficult it is to exclude vegetation under certain circumstances. The only mode in which the writer could arrest vegetation in water exposed to light in glass flasks, has been by *boiling* the water in the flasks, and sealing their necks the moment after ebullition ceased, thus forming a vacuum in addition to killing the spores by heat. Plants have even come spontaneously, though slowly, in sea-water prepared artificially with distilled fresh-water to which Mr. Gosse's formula of salts has been added. Contact with air only was allowed in this case.

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* The oft-quoted experiment of Dr. Johnston, in which that gentleman imagined that he had proved the vegetability of *Corallina officinalis* (a calcareous sea-weed) by associating it in a glass jar with certain animals which the corallina was supposed to have furnished with oxygen, in reality *proved nothing;* for, in the first place, it is recorded that other plants—confervæ among them—were already growing upon the corallina, and, in the second place, even if these plants did not previously exist visibly, others would have appeared, spontaneously, to do the work, if there was light enough to keep alive any plants at all. The corallina, under such circumstances, did neither good nor harm, because it was a small, hard, chalky plant, with very few soft parts in it to decompose, if it died. In the same manner, the other earlier experimenters, commencing with Mrs. Thynne, in 1846, and including the observers who published their experiences from about 1850 and 1851 to 1855 and 1856 (although they worthily did everything to cause a taste for Aquaria), were in most instances in error in their mode of employing vegetation, inasmuch as they introduced kinds which for the greater part would not grow (or, if they grew at all, were needless), and when these died, there would have been no success, if nature had not interposed and provided proper kinds in their places. Thus a growth was at last obtained, not because of any effort to get it, but because nature supplied that which was required to meet the exigencies of each particular case. Much exertion was at this early period employed, in a fruitless manner, to remove the natural growth by the use of scavengering mollusks, instead of more sensibly endeavouring to prevent its *excessive* coming at all, by proper management of light, and by thus converting evil into good.

but the result of the slow decay of this form of vegetation is the deposit of a quantity of the substance termed "humus" (which, being somewhat of the nature of charcoal, is quite harmless in the water); but it is at any rate a dirty-looking, loose, brown substance, which is ever liable to be stirred up when the water is disturbed, and is not easily removed. There should be an endeavour, therefore, so to regulate the light and the temperature in an Aquarium that only just as much vegetation is produced and maintained as will keep the water perfectly clear and unchanged; the glass of the Tank clean; and the proper number of animals in a vigorous state. On the other hand, the illumination should never be so feeble and indirect as only to produce a minimum effect, *unless* there is an intention only to keep one or two isolated small and delicate animals in a comparatively large body of water, and in such a case the plant-life *may* be conveniently reduced to its lowest state of activity. For instance, an ordinary glass fish-globe measuring ten inches in its greatest diameter, and eight inches in height, covered by a piece of glass, placed on a marble slab against a wall in a cool eastern room with never any fire in it, standing 5 feet from a small ground-glass window, and shaded by another globe between it and the light, obtains so small a degree of illumination that the sea-water in it remains perfectly transparent, and without the smallest apparent vestige of vegetation in any part of it. Yet of course some infinitessimal portion of plant-life must be present; and in the globe live permanently and healthily a couple of worm pipe-fish *(Syngnathus lumbriciformis)*, each weighing eight grains, because the arrangements are in accordance with the constitution and habits of the fishes. The situation is cool and shady; the amount of animal life is very small (though it is at its maximum); while the volume of water is large, all is kept very clean; and, as the creatures have their mouths formed for taking in infusorial food only (with which the water abounds), there is no chance of fouling the water by the putting in of solid food. Moreover, as these fishes occasionally swim about, or balance themselves with their tails resting on a piece of stone, and with their heads close to the surface, they obtain air by the act of doing so. This, therefore, is an example in which the least possible supply of oxygen from vegetation is shown to be sufficient to meet a known requirement. But it is ascertained by direct experiment that a moderate sized anemone *(Sagartia viduata)* does *not* flourish under the same circumstances, as it lives at the bottom of the vessel, and requires air to be supplied to it otherwise than by its own seeking, and moreover, it needs to be fed, and to have the results of its food afterwards rendered harmless by being made to combine with oxygen. If this oxygen were to be supplied by plants grown quickly and abundantly by the globe being placed close to the window, the confervæ would grow over the sides of the glass and be unsightly. But if a proper Tank, with two opaque ends and a sloping back be used in the latter situation, all the requirements which would be needed by any animals adapted to that Tank would be complied with, and if the vegetation grew on the opaque portions of the Aquarium, good, and not harm, would be produced by it. Whenever there is light enough to enable the contents of an Aquarium to be seen at all, some vegetation will be certain to come. Yet, if the light is very trifling in amount, the plants will be tardy in making their appearance, and they may even be arrested permanently in number and kind, so that only a very slight trace of them may be seen after a long space of time and by making careful search. Under such circumstances, the usefulness of the vegetation is much curtailed; and if no increased light can be provided, the number and size of the animals must be curtailed in the same proportion. When the light is insufficient and the situation hot, the water has a kind of "dead" appearance, very different from the bright sparkle of well aerated fluids. It is not necessary or desirable that in Aquaria the oxygen should be constantly rising from vegetation in the form of visible bubbles or beads, yet there should always exist the means of being *able* to obtain such bubbles by letting in more light when required, as, for example, within some hours or on the day after feeding the animals, when a larger quantity of oxygen than usual is needed to get rid of and to consume any milkiness which may be caused in the water by uneaten or rejected portions of the food. In winter, a little mid-day sunlight may be permitted for short periods—an hour or so at a time—and in summer, there may be no great harm in the very early morning sun, if the state of the Aquarium requires it. Generally however, Aquaria having a due eastern aspect should be shaded *overnight,* in hot weather. Artificial light has in some cases been used for the growth of flowers and other terrestrial plants, but there are no recorded instances of its effect on the lower water-plants.

The growth of red sea-weeds is best attained by the proper treatment with respect to light of the germs found on the masses of shells, &c., upon which serpulæ, &c., are met with. Interesting microscopic animals are also bred from these masses, which are referred to at pages 19 and 23.

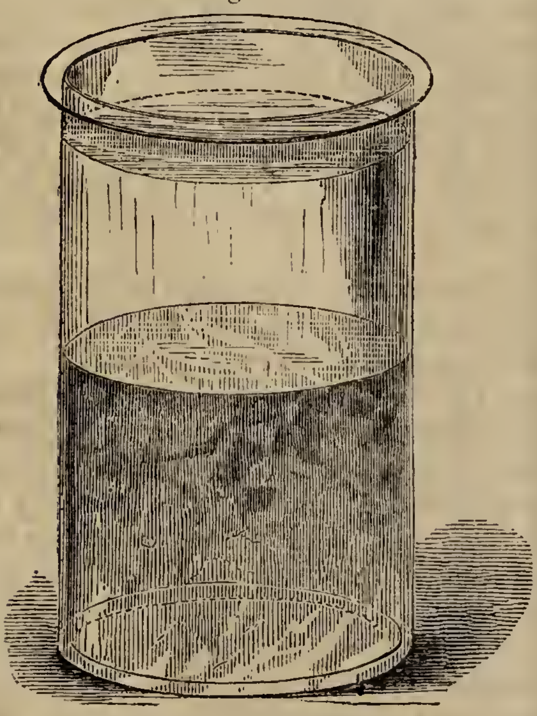
If well chosen, most of the red sea-weeds are easier to keep than green ones taken direct from the ocean, and the kinds which are most successful are very small specimens of Chondrus, Rhodymenia, Phyllophora, Dictyota, and particularly the hard round wiry species, such as Hypnea, Corallina, Gelidium, Furcellaria, Rhodomela, Gracilaria, and Gymnogongrus. One of the difficulties attending the growth of these is, that when they are kept in Aquaria in which light exists abundantly enough to cause the growth of conferva for the oxygenation of the water for the animals, the conferva covers and disfigures the red sea-weed also; and if the light is then shut off and the conferva dies, the animals suffer in *their* turn. Red sea-weeds, therefore, should be kept in much-darkened Tanks in which the animals are rendered subservient in number and size, to the vegetation.

The old, clumsy, unphilosophical, dirty, and utterly useless mode of endeavouring to keep down excessive growths by means of so-called scavengering snails is now quite exploded. This plan was recommended by the earlier experimenters as an imaginary method of combatting the evils consequent on the erroneous tanks then, and still, much used, quite forgetting that "prevention is better than cure." A proper Tank in a proper situation needs no such scavengers; and a wrong situation, or an improper Tank, is not helped by them.

The management of light is so important a consideration in Aquarian operations, and it is such a very interesting department, that it is not possible to say enough about it in a little pamphlet like the present.

Natural light, whether derived from the direct rays of the sun, or from the sky generally, never falls on any substance, however apparently obdurate it may appear, even for a fraction of a second, without leaving some impress; and the intensity of the impression depends on the intensity of the light, the time of its duration, and the capabilities of various bodies for receiving it. In photographic operations it produces results which are strikingly apparent in a few moments, or even instantaneously, while some other substances require the lapse of considerable periods before any visible effects are perceived. Thus, some colours fade when exposed to light; and though the fading begins at the first moment of exposure, the distinct visibility of the change by the unassisted eye may be a matter of weeks, months, or years. Possibly, even, no external and readily appreciable difference may *ever* become apparent without the presence of subtle tests. For instance, a quantity of earth has been taken from a deep mine into which daylight has never entered, and, being divided into two portions, one of them was covered up and kept dark, while the other portion was exposed to sun light for a few minutes. No difference that the unhelped eye could discern was wrought by this exposure; but it was found that the portion of earth, upon which the sun had shone for a very brief period, was capable of imparting an image to photographic paper laid upon it, even after a long interval, while the unexposed earth obtained no such property. These facts, and many others which can be adduced, prove the universality of the law which determines that every substance upon which light ever shines, experiences some alteration of condition. In a similar manner, it works changes on vegetation. It intensifies the green colouring matter of plants; and whenever vegetation is not altogether killed by its absence, it at all events becomes blanched and sickly.* Furthermore, the incipient germs of vegetation, together with fully-grown microscopic plants, exist everywhere by millions, floating in the air, and suspended in water; and they are always ready and waiting to be developed into visible growths whenever the conditions of proper resting places, and the necessary light, are given to them. Thus the bark of trees presents a surface well fitted for the growth of lichens and mosses, and accordingly the trunks of growing timber are usually found to be covered spontaneously with those plants, and their order of appearance, kind, number, and vigour of growth are chiefly determined by their position on the trunks relatively to the light, and they are most luxuriant on the side facing the *south*. The application of all this to Aquaria is direct and simple; for on precisely the same principle, whenever daylight rests upon and penetrates into water for a sufficient time, and in sufficient amount, plants are certain to make their appearance. But as moisture is so favourable to their development, the quickness with which they are produced is comparatively much greater than when the germination takes place in or upon drier substances; and therefore water (in Aquaria, at any rate) needs no such stimulus as a southern light to cause the appearance of minute plants. For example, fig. 93 represents a glass jar (loosely covered by a glass disc) which was half-filled with clear sea-water, *containing no visible vegetation whatever*, and this was exposed for some months in a window with an eastern aspect, until its sides became quite covered by a minute growth of plants, represented by the darkly-shaded parts of the wood-cut. The jar was then filled up with sea-water as far as the top water-line, when some more plants grew over the part of the glass newly covered with water, but at a much faster rate than they appeared on the first portion, because, in the first instance, the vegetation

Fig. 93.



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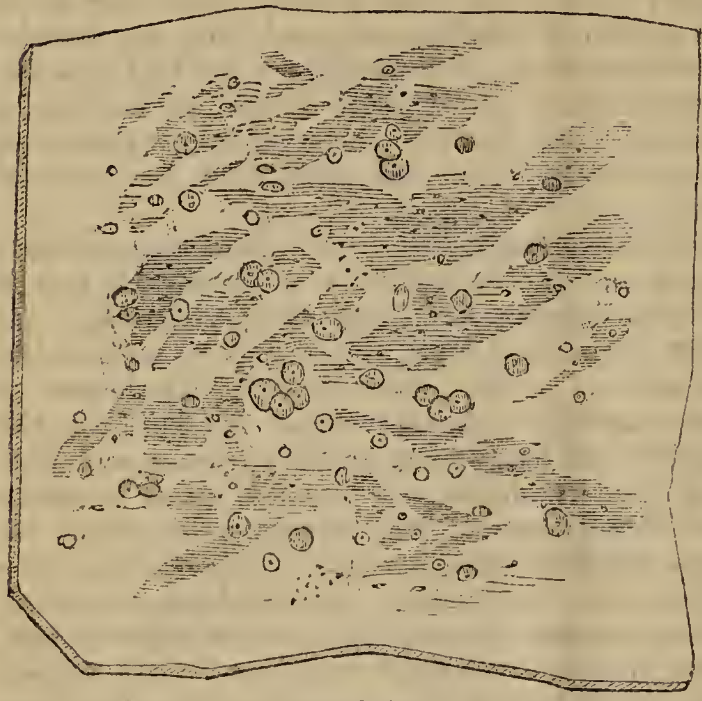
* Red seaweeds seem to form an apparent exception to this statement, for their colours are deepest where the light in which they grow is much modified in quantity and quality by great depths of water.

had to be *originated*, while in the case of the second growth, it had merely to be *continued*. Therefore, although it is quite possible to obtain a growth of plants in an Aquarium solely by the influence of light upon the germs which are always invisibly existing in the water, and without putting in any visible plants at all, yet the introduction of as many as are indicated in fig. 92 so greatly *hastens* the operation (in the same manner that the first growth in fig. 93 hastened the second growth), that, for all practical purposes, it should never be dispensed with. The plants in the tube are of species which have already grown in confinement, and they are thereby well fitted to grow again in confinement; and thus, by a kind of inoculation, there is secured a reproduction of those plants which are known by experience to be better than any others, both for their oxygenating services, and for their beauty of appearance when the rock-work has become gradually covered with them.

At page 138, reference is made to the order in which certain vegetations succeed each other, as occasioned by the influence of light. By this is meant, that some simple kinds appear first, and these, decaying, are supposed to furnish a manure for another kind, a step higher, and to the latter a third set succeeds, and so forth. If two or three kinds can be imagined to have their spores existing in all water which is taken from the sea, it is not difficult to imagine that many more are also present, and, that while all in turn are waiting to be developed, the chances never or rarely occur for some of them, and they therefore, may remain undeveloped for any length of time, until some circumstances, working together, and appearing to be accidental, may cause some of these spores to be suddenly developed. This is offered as a possible explanation of casual growths of higher plants, from no *apparent* cause; but the statement must be accepted with caution because of the necessarily imperfect knowledge yet possessed on this point. It is not even known why the earliest vegetation which appears, is not uniform in kind, as it was at one time supposed to be, for although in many cases certain unicellular plants (known as *Diatomaceæ*) are the first comers, yet in some instances a somewhat higher development is the forerunner of the rest. This, however, does not alter the fact, that some vegetation always does come wherever *moisture*, *light*, and *air* coexist.

The services done in Aquaria by the oxygenation performed by plants, and that effected by the direct action of the atmosphere, require to be compared together, and defined with some exactness, so as to prevent the mistake of supposing that any amount of vegetation, however grown, can overcome the evil of a Tank of disadvantageous proportions with respect to its surface exposure of water. The purpose of plants is to decompose the poisonous carbonic acid gas given off by animals; the carbon being absorbed into the substance of the plants, and the oxygen being set free for the use of the animals. But it is equally true that the vegetation cannot be dispensed with, however good the form of Tank may be, because no surface aëration, whatever may be its extent (the water being in nearly a a condition of stillness, as it usually is in Aquaria), nor any other known means whatever will serve the purpose which plants serve in decomposing the carbonic acid gas. *That alone* is the province of growing vegetation. Yet again, on the other hand, whenever (to try to compensate for the want of a sufficient oxygenating surface in a wrongly proportioned Tank) an attempt is made to cause the vegetation to do more than its own work, by obtaining a rapid and large growth of it by increasing the quantity of light, and so of copiously evolving oxygen bubbles, then not only is there a failure in attaining the result desired, but other inconvenience is added to the former one, namely, that, by the plants being forced in this manner, the rock-work, the shingle, and the transparent portions of the Tank, become quickly overgrown with them to an annoying extent.* One form of minute vegetation, with which the glass becomes commonly and densely coated, is shown in the annexed figure 95; and this is so difficult to remove, that breakage of the glass sometimes takes place in the effort to scrub or scrape it off; the fragment in the engraving being from such a Tank as fig. 3, p. 46, so broken. Lastly, the excessive growth usually ends by the conversion of the whole body of the water into a thick, opaque, greenish-brown mass of fluid. It is of but little use to attempt to avert this by any curtains, screens, &c., placed around such vessels as figs. 3, 44, 45, 46, &c., because then the opposite extreme is run into. The conclusion arrived at, therefore, is, that while plants are essential to render the carbonic acid gas harmless, the *main supply* of oxygen for the general use of the animals, must be from the atmosphere direct; and so, as there exists this clear line of distinction, there should be no attempt made to cause either of these sources of supply unduly to take the place and office of the other. In this manner, too, it is seen, that not only does the health of the animals, but also the clearness of the water, depend indirectly on the right proportions of the Tank. At the same time it has to be explained that in all ordinary Tanks not having the dark-chamber principle applied to them, it is so very difficult to admit sufficient light without giving too much, and to exclude it without doing so to a too large extent,—that the exact medium can very rarely be sustained permanently. But the dark-chambered Tanks enable this difficulty to be surmounted by permitting the light to be sometimes admitted slightly in excess, and with impunity, because the dark chamber tends to counteract and adjust the effect of that excess, as the locomotive plants, or the spores of plants, which cause the greenness, will not exist in the dark portion, and the latter, therefore, is continually exercising its good influences on the light portion.

Fig. 95.



Actual size.

There still exist some few persons, who, in spite of all teaching to the contrary, affect a liking for the old vessels glazed on all sides and filled with great leafy and bushy plants, because of some fancied and temporary "prettiness" presented by them, quite forgetting that a "pretty" effect should be produced by following right principles.

The engraving at page 145 represents one of the Tanks (A to H) stocked, and an attempt is made to indicate (with some approach to accuracy) a general notion of the numbers, kinds, and relative sizes of the animals which may be safely and constantly sustained in them supposing that all the right conditions of light, temperature, &c., are complied with.* There are sea-anemones of several species, corals, starfishes of two or three kinds, a sea-urchin, a sea-cucumber, a group of serpulæ, a sabella, and some mollusks.† These can be differently varied, if required, by having fewer starfishes, and more of the other objects. But it will be perceived that in this wood-cut there are no crabs, prawns, or fishes, because it is found to be quite impracticable to keep them (on account of their destructiveness, and their need of much oxygen) when mixed with quiescent creatures, except in very large Tanks, and even then the association must be cautiously managed. But some small crustacea, and even a few of the smaller and hardier marine fishes can be kept in Tanks A to H, if the Aquaria are devoted to them alone (yet not so much crowded together as anemones, madrepores, and serpulæ may be kept); and the very moderate price at which these vessels are offered, will, it is hoped, enable this separation of species—upon which so much depends,—to be more often effected than it hitherto has been. If *this* be attended to; if there is a disposition to be satisfied with what a little experience teaches every individual Tank to be capable of, letting that be done thoroughly well, and not fruitlessly trying to make it do more; if care be taken to secure a spontaneous growth of minute plants before any creatures are put in; if the growth be afterwards equally sustained by right management of the light; if a cool and moderately illuminated situation is chosen in summer; if there be a judicious feeding, once weekly, of as many animals as will take such food as can be given them by hand (see p. 108); and, finally, if there be careful removal of rejected or undigested food, so that all be kept scrupulously clean, then the first expense of animals may be also the last, and there need be no deterioration in them for very long periods. Sea-anemones and their allies are very long lived, and instances are known of individuals being kept in confinement for more than thirty years. Let the size, the proportions, the small quantity of glass, the large amount of strong opaque material, the avoidance of great sea-weeds, and the economical distribution of water in the improved Tanks shown at pages 49, 50, 60 to 65, and page 145 of this publication, be compared with the narrowness, the tallness, the frailty, the wasteful and disadvantageous use of sea-water, and the difficulty of managing the distressing glare of light in the old forms of Tanks. Above all, let there be a remembrance of the wild notions formerly and still entertained by some Aquarian authors and their readers respecting the absurdly large numbers and very incongruous kinds of animals supposed to be capable of being safely placed together in one Aquarium, and let there be a comparison of such notions with the sober ideas here set forth on the subject, both in print and by the illustration given in fig. 96. It is believed that there will then be no difficulty in comprehending the causes of the numberless failures in Aquaria since their introduction in 1853. The capabilities of Tanks in which the water is unchanged (not that there is ever any need of changing it, however) and in which there is no constant motion given, have been hitherto largely overstated. There are but very few kinds of active and highly organized aquatic creatures which can be kept permanently, in warm weather, in satisfactory numbers, with comfort to themselves, and with pleasure and but little trouble to their owner, if the attempt is made in small vessels in which the water is devoid of motion, and in which there is an absence of various contrivances to imitate natural conditions more perfectly than any still mass of water ever can imitate them. An Aquarium in which there is an improper admixture of animals is a constant source of misery and destruction, for (even if all possible means are taken to supply an abundance of oxygen) the fishes are perpetually coming in contact with the stinging tentacles of sea-anemones, or else getting within reach of the pincers of fierce crabs. Then the crabs upset the quiet anemones and serpulæ, and prawns are constantly thrusting their claws into the tubes of the latter with intent to devour the inhabitants, and they, and all others of the smaller crustacea, employ themselves much in destroying microscopic objects as fast as they appear. Yet there need be no discouragement felt at this somewhat rigid statement of limitation, for it is only by its adoption that any *one* class of animals can be kept properly; and it is by the neglect of it, and by attempting to do more than can be done, that *nothing* is done well. Everything should be valued, of course, not for that which it can *not* do, but for that which it *can* perform. And the number and variety of objects which can be successfully maintained when judiciously grouped in even the smallest Marine Aquarium, is large enough to be of inexhaustible interest.

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* See page 157.

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* The one drawn from is H. The objects must be varied in kind, number, and size, to suit the other Tanks, A to D.

† The question so constantly put, concerning *the number of animals to be kept in a stated quantity of water*, is so difficult to answer in such manner as to give a determinate standard applicable to all contingencies, that reference to *figures*, as expressive of bulk and number, is of no service whatever; and therefore, the matter must be settled by taking into consideration all the circumstances of every case to be decided upon. Thus, some authors have endeavoured to give such a rule as one dozen, or half-a-dozen of any creatures of the average size of a common smooth sea anemone, to one gallon of water. But the habits and degrees of hardiness of all creatures are not alike; and even if they were all similar in hardiness, other circumstances are so varying, that the very same creature which may at one time not live in a whole gallon of water, arranged in a certain manner, may at another time exist happily in half-a-pint, under other circumstances of distribution, temperature, growth of vegetation, &c. Then, again, the same gallon of water which under certain conditions would not support the life of one or two animals, may, if these conditions be altered, be rendered capable of maintaining a whole dozen of the very same kinds and dimensions. And, although fig. 96 is intended to show the amount of animal life which may be placed in a Tank of known dimensions (H), under a combination of all favourable circumstances, yet there may be other circumstances in which the numbers must be reduced, or the kinds changed, or the same quantity be placed in a larger Tank. Suppose for instance, that Tank H, shown stocked in fig. 96, is a representation of it in a well-lighted and cool northern or north-eastern aspect, in the warm months of the year. But it does not follow that the same numbers and kinds would flourish, in the same season, and in the same Tank, in a *western* aspect, which is much hotter. So, in the latter supposed case, either a larger Tank must be used for the same number of animals, or the number of animals must be diminished, or the same quantity of water and animal life must be spread over a larger space.

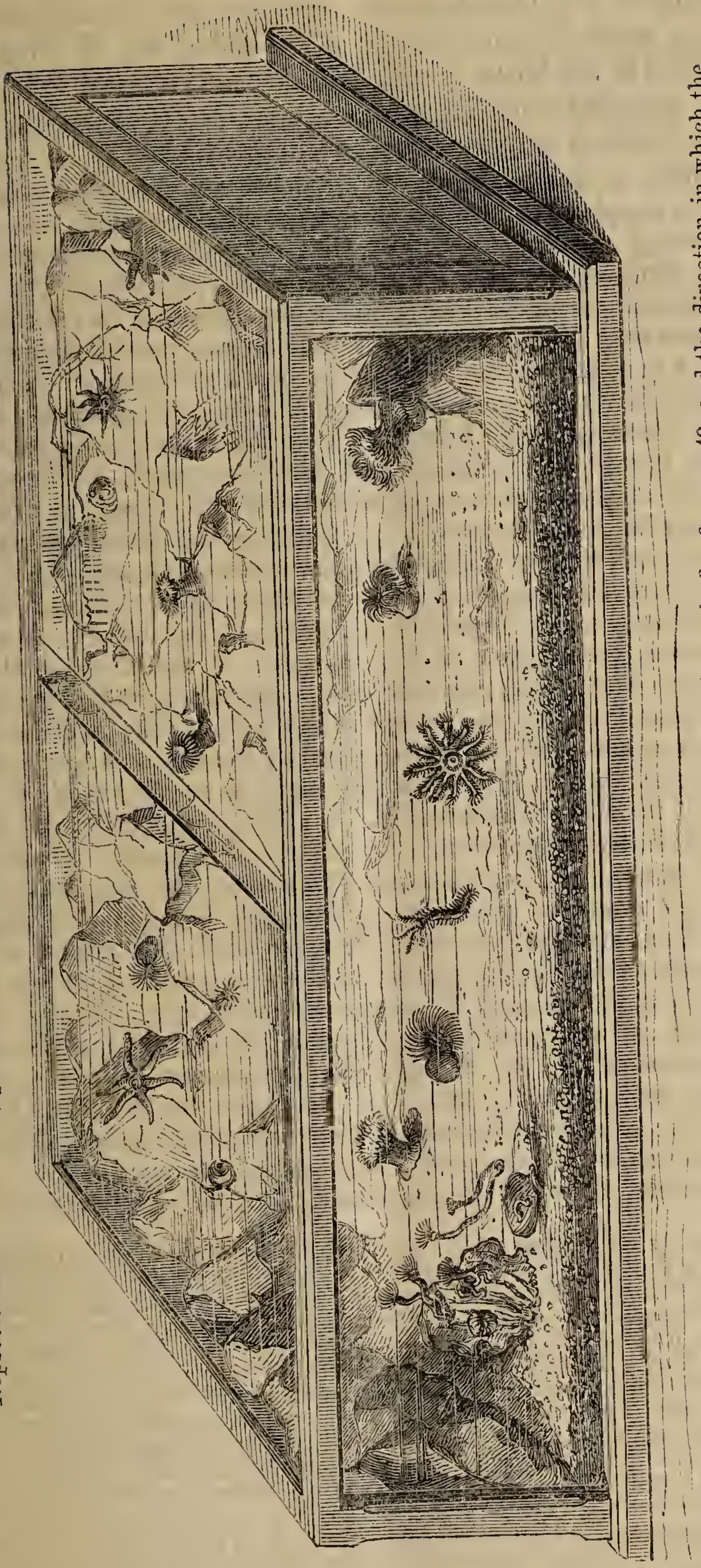
These are considerations which do not invest the subject with difficulty, but which give it interest by reference to chemical laws. *Moreover, that which is very easy to do is never worth doing at all.*

Five minutes of vigilant attention paid regularly, *and as a habit*, once a day, in the morning, is more than sufficient to keep in order any of the Tanks here named; but when this duty is once well performed, there should be no after fidgetting with the animals. Those who succeed best with Aquaria are not learned persons with vast stores of book-knowledge any kind, nor are they those who take up the subject as a transient fashion or amusement, but they are usually plain practical men and women, having a disposition to enquire into and to understand the reason for everything they see.

For the convenience of purchasers of Tanks A to H, a scale of prices for smaller quantities of sea-water than are named at page 43 is arranged thus:—

A two gallon wickered stone bottle of sea-water, 5s., of which 3s. 6d. is returned if the bottle is sent back free and in good order.

Fig. 96.



Representation of Tank H, permanently stocked with Marine Animals. For prices, empty, see page 148.

⁂ The transverse section of this Tank is nearly the same as that shown in fig. 6, page 49, and the direction in which the light is admitted, is also indicated by the same figure.

As the above engraving is a representation of only one Tank (H), it has the disadvantage of not showing the proportions of Tanks A to D, or the more square forms of E and F.

A three gallon wickered stone bottle of sea-water, 6s. 6d., of which 4s. 6d. is returned if the bottle is sent back free and in good order.

A four gallon wickered stone bottle of sea-water, 8s., of which 5s. 6d. is returned if the bottle is sent back free and in good order.

A five gallon wickered stone bottle of sea-water, 9s., of which 6s., is returned if the bottle is sent back free and in good order.

These rates, as well as those of all other articles to which prices are affixed in this supplement, are for cash sent with the order.

It is scarcely needful to repeat, that sea-water in Aquaria never requires to be changed, even for illimitable periods, if it is rightly managed; but if by accident, or from early mismanagement of any kind, it should become temporarily fouled to any extent, however great, it should not be wasted, and it may always be restored by being set apart in an open vessel of *earthenware* (such, for example, as a foot-pan, or a pickling-pan, but not in any vessel which is made of wood, or of metal, or which is painted) when in a few days it will become clear and free from smell, on account of the oxygen of the atmosphere having consumed all decaying organic matters.* It may be then put away in clean stone bottles, taking care not to disturb any settlement which may have subsided, and in a few days afterwards it may be corked so as to be again fit for use at any future time. This arrangement implies the having, at the outset, of a quantity of water double the amount of the capacity of the Tank, and the plan is indeed always a safe one, however good the management may be. All new specimens should be washed in a little sea-water, and be placed in a shallow dish of sea-water for a probationary period of a few hours before being put in the Tank. The water so used, is to be saved, oxygenated, and returned to the "stock-bottle." The evaporation of the water should be occasionally ascertained by means of a specific gravity test, or by a pair of tests—see page 98, fig. 59—but this evaporation should be retarded as much as possible, by keeping the glass covers on the Aquarium. The covers also exclude dust and soot, and afford a means of regulating light. The opening between the two pieces of which the cover is composed is quite enough to admit air, and this opening is further useful as being an aperture through which the water may be sometimes agitated and aërated (as, for instance, on the day or within a few hours after feeding), by moving a little stick or pencil in it briskly backwards and forwards for a dozen or twenty times—the cover remaining in its place the while, and preventing the water from splashing over.

The rock-work is to be built-in like fig. 96, and prepared by cleaning and soaking-out according to some printed directions to be found on the bottle or canister of cement.

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* One universally correct test of the perfectly healthy state of an Aquarium is given by the *clearness of the water;* and this should be not merely the dull and insipid clearness observable, for instance, in newly boiled cold water, from which air has been expelled; but it should be the sparkling brilliance which only can be given by the presence of an abundance of air in solution. If the water is *milky*, the presence is indicated of decaying animal matters, or of animals in excessive numbers. If the former, the *cause* should be carefully searched-for and removed, when the *effect* will begin to cease; but the water need not be changed. Sometimes the source of impurity may be found in a patch of blackened sand or shingle, beneath a stone or mass of serpula, when any *visible* offensive substance there be may be removed with a tube (see p. 96, fig. 51,) and the blackness itself may stirred-up, when it will gradually disappear. If the animals are too many in number, some should be removed. When an Aquarium is fairly stocked and in good order, there should be a resistance to the temptation to add more, even if they can be had for nothing at the sea-side. It is found that specimens so obtained are in the end very costly. Above all, there should be a firm declining of the generally injudicious offerings of animals and plants made by friends. Unless a good deal of knowledge has been gained by actual personal experience in these matters, safety is best sought in "letting well alone." If the water is *green*, it betokens a too great activity of vegetation.

Before pouring in the sea-water, the Tank should be well washed out, twice or three times, with clean fresh water. The emptying, after each wash, should be done by means of a syphon (see page 95, fig. 50), and for this purpose a small one, price 1s. 6d. (or 1s. 8d. by rail) is prepared for Tanks A to H. At the last emptying, care should be taken to see that no fresh-water remains in the dark-chamber, therefore the Tank should be tilted forwards towards one corner, whence it may be removed with a sponge. Finally, there should be a rinsing with a pint of sea-water, this being saved. The sand and shingle are sent clean, but they should be washed again, and drained, and rinced in the saved pint of sea-water and again drained, and then strewed in the Tank in front of the slope. The sea-water may then be introduced, not by a violent pouring, but by being gently syphoned in clear. Scrupulous cleanliness must be observed. Then follows the growth of the plants as named at page 135, but there must be no animals introduced until the vegetation has actually grown, whatever may be the impatience felt in having to wait. If more instructions be required, they can be obtained by a written or personal application. The prices of animals are given at pages 23 to 33. The use of various contrivances enables them to be kept in large numbers in a state of higher health than was formerly possible, and they are therefore now cheaper, because better. Information on their natural history may be obtained from the books enumerated at pages 109 to 116. Sea-anemones and madrepores have been specially and copiously treated upon in Mr. Gosse's recently completed work on them, of which a prospectus is sent with this publication. The best and most comprehensive small book on British marine animals generally, is Mr. Gosse's admirable "Manual," see page 113 of "List."

The tiresomeness of having to administer food in small morsels, placed separately within the grasp of the tentacles of each anemone or madrepore, when a deep Tank is used, is apparent when compared with the easy reach afforded by a shallower vessel. The act of feeding is then an interesting process, because every animal is well in sight and equally accessible. A paper on the food of animals in Aquaria can be had, price 2d., or post free for three stamps. A small pair of wooden forceps, especially made for feeding animals in Tanks A to H, are now ready, price 1s., or by rail for 1s. 3d.

The following list of sizes and prices are for the Tanks empty, but including the dark chamber and a pair of stout glass covers. The rock-work, and the cement to fix it, with printed directions, and with the shingle or sand, and basket, amount to 2s. 6d., or to 3s. if the rock-work is wished to be ready fixed-in when the distance to be travelled will allow that to be done with safety. The rock-work (*Mica schist*) is the best known for the purpose, and the cement does not injure the water or animals, (see page 44).

When these Tanks or other goods are for places in and around London, to be delivered by private messenger (and not by rail, parcels company, or carrier), no charge is made for packing-case, and the delivery is free within two miles of Regent Circus. Beyond that distance private delivery is 6d. per mile, and settlement of the account is in these instances to be made on receipt of the goods.

The rates are fixed so low as to admit of no other arrangement than that of *a remittance* (by money-order drawn on Old Cavendish Street), *being sent with the order for goods*, adding 12s. 6d. for packing-case, of which 10s. will be returned when it comes back in good condition and free of expense, railway and other carriers usually conveying "returns" for a few pence.

Not subject to credit or discount.

		£	s.	d.
A.	18 inches long, 13 inches broad, 5 inches high, plain painted and varnished	1	9	0
B.	The same, ruled with gilt lines on the edges, and in panels	1	13	6
C.	22 inches long, 13 inches broad, 5½ inches high, finished as A.	1	14	6
D.	The same, finished as B.	1	19	0
E.	18 inches long, 18 inches broad, 6 inches high, finished as A.	1	16	6
F.	The same, finished as B.	2	1	0
G.	24 inches long, 16 inches broad, 7 inches high, finished as A.	2	6	6
H.	The same, finished as B.	2	11	6

See page 145.

*** *The above measurements are outside. The colours are dark green or chocolate. It is suggested that when the Tanks are to be placed in well-furnished apartments, the gold lines should not be omitted, as they are in good taste and unobtrusive, and they add much to the prettiness of effect. Tanks of any dimensions, whether they are combinations of the above sizes or not, can be made to order, to fit certain spaces, at slightly advanced rates.*

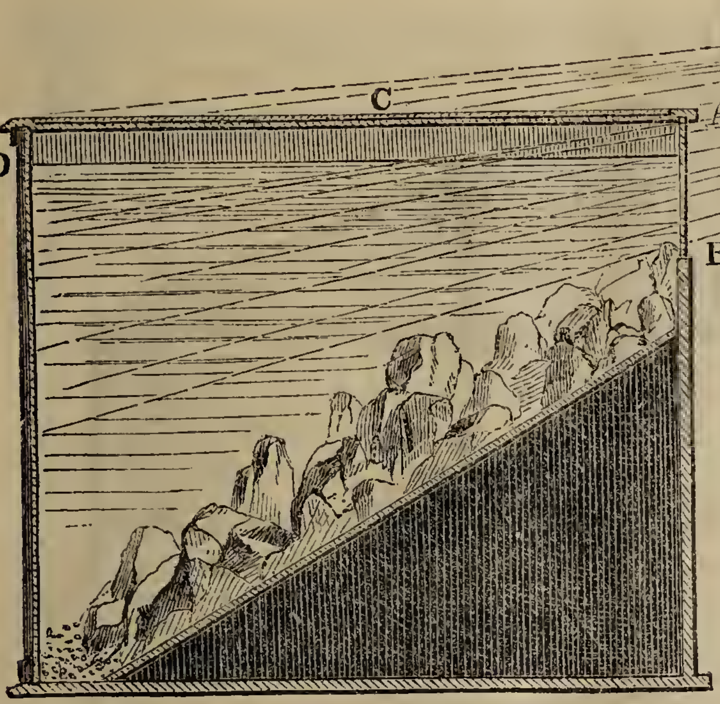
Stands may be had of stained deal, oak, mahogany, and walnut wood, from £1 to £3. Packing 2s. extra.

Neat Brackets may be had in these woods, or in iron, at from 15s. to 20s. per pair.

The manufacture and sale of such built-up angular Tanks as are shown by fig. 3, page 46 (having glass on all sides, and with iron, zinc, brass, glass, or slate frames), and of all vessels of circular, vase-like, or globular shape, blown entirely of glass, and represented by figs. 44 to 49, page 90 to 94, are discontinued at Portland Road, experience having proved their inutility for all general purposes. They are very liable to break; they are so transparent that their proper illumination is extremely difficult to manage; and their ability of sustaining animal life is so small in comparison with the bulk of water they contain that they are perpetually causing failures by their deceitful appearance in this respect. Instances are known of Tanks like fig. 3, holding forty gallons of water (and which therefore are expensive), which *in consequence* of their being tall and narrow, have not as much capability of maintaining animals as other Tanks, made broad and shallow, and containing only *forty pints* of water, and which are of course *not* expensive in cost.

2. There sometimes occur a few instances in which it is necessary to occupy spaces of limited width with Tanks of less breadth than would be otherwise adopted, and yet where a rather greater height than that of the standard Tanks (Nos. 1 to 15) may be made use of without much danger. In such cases, to avoid too great steepness of the slope, it is made to terminate at the point B, in fig. 97, and the space A B is filled with glass, through which most of the light enters. C is the cover, made opaque, but capable of being placed at an angle by a hinge in front. D is the water line. This form of Tank is termed "composite" from being

Fig. 97.



Section of Composite Tank.

No prices are affixed to this form of Tank, or to those shown in figs 98 to 101, as, being necessarily variable in arrangement, they must be subject to contracts when ordered.

composed partly on the plan of those at pages 60 to 65, and partly on the plan of those at pages 70 to 73. It is recommended only in cases of actual necessity, or when a running stream can be commanded.

3. A good plan of accommodating a large patent Tank, so as to occupy no space within-doors, is shown in the three following engravings: that at p. 150 being a sectional view; the one at p. 151 being a front view; and that at p. 152 being a back view of the same structure; and the reference letters being also alike in the three pictures. A is a strong timber frame-work, placed outside a house,* partly supporting the Tank D D, the front portion of which is placed upon and through the wall K, until the glass-observing front is flush with the inner face of the wall in the room H H. The Tank is surrounded by a non-conducting substance, E E, to prevent the excessive action of hot or cold weather. The whole is enclosed by a wooden jacket, B, and upon and around the upper edge of the latter is built a glass enclosure, C, provided with opening windows, C′, for admission of air. The enclosure has a "lean-to" glass roof terminating at K. F F are semi-opaque covers hinged in the centre, and capable of being opened and closed, and retained in any retired position for controlling the admission of light, and for regulating the growth of vegetation, by cords, pulleys, and counterpoises. G is a lamp with open conical shades to throw a strong light downward on the Aquarium at night. The opening, L, in the wall may be either the opening of an existing window, or one cut out for the purpose. A blind, (shown with its end and tassel at p. 151,) may be drawn down as far as the top bar of the Tank when needed, so as to shut off access between the room and the upper part of the Tank enclosure, or it may be pulled down quite over the glass. Thus an Aquarium need occupy no space

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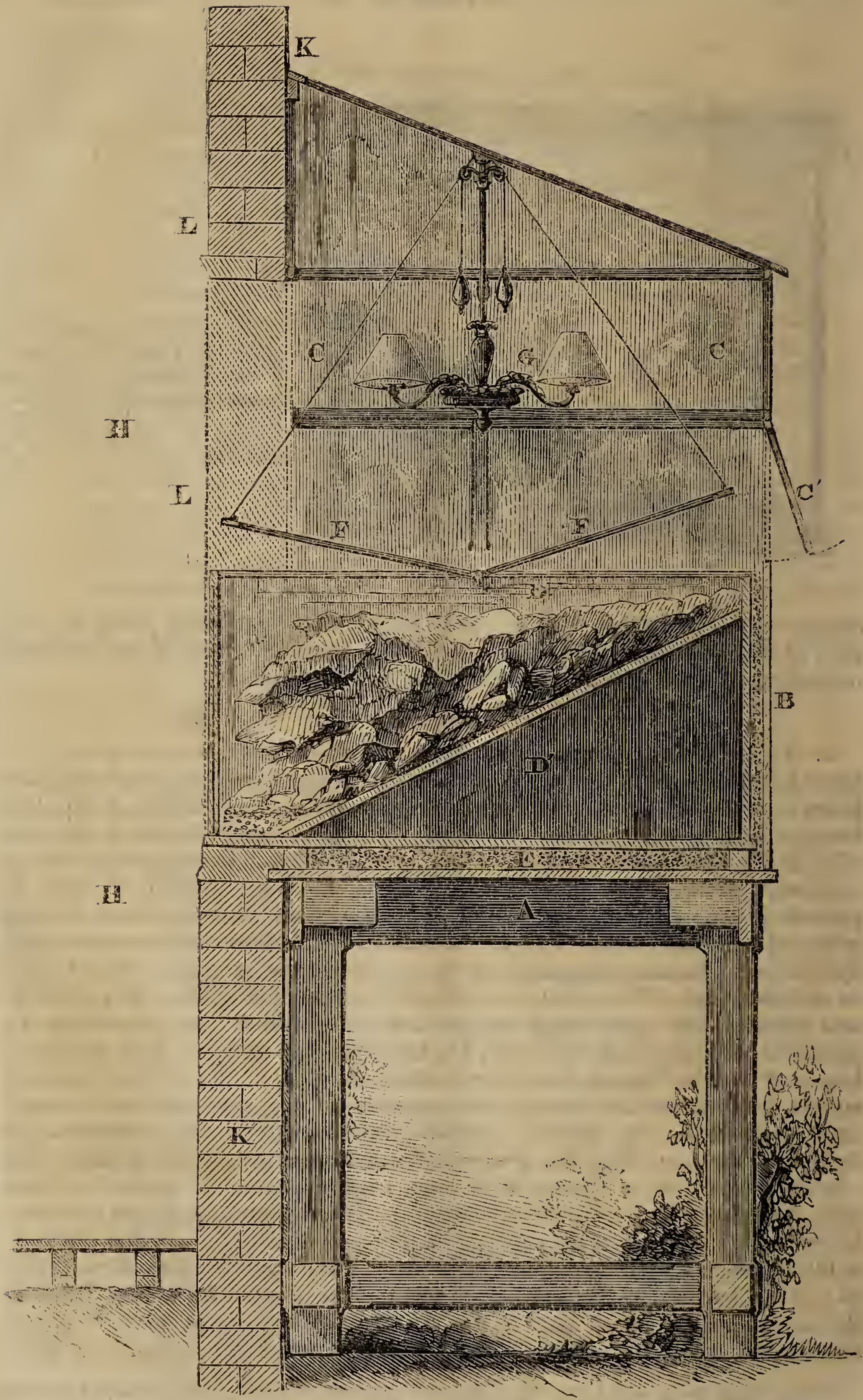
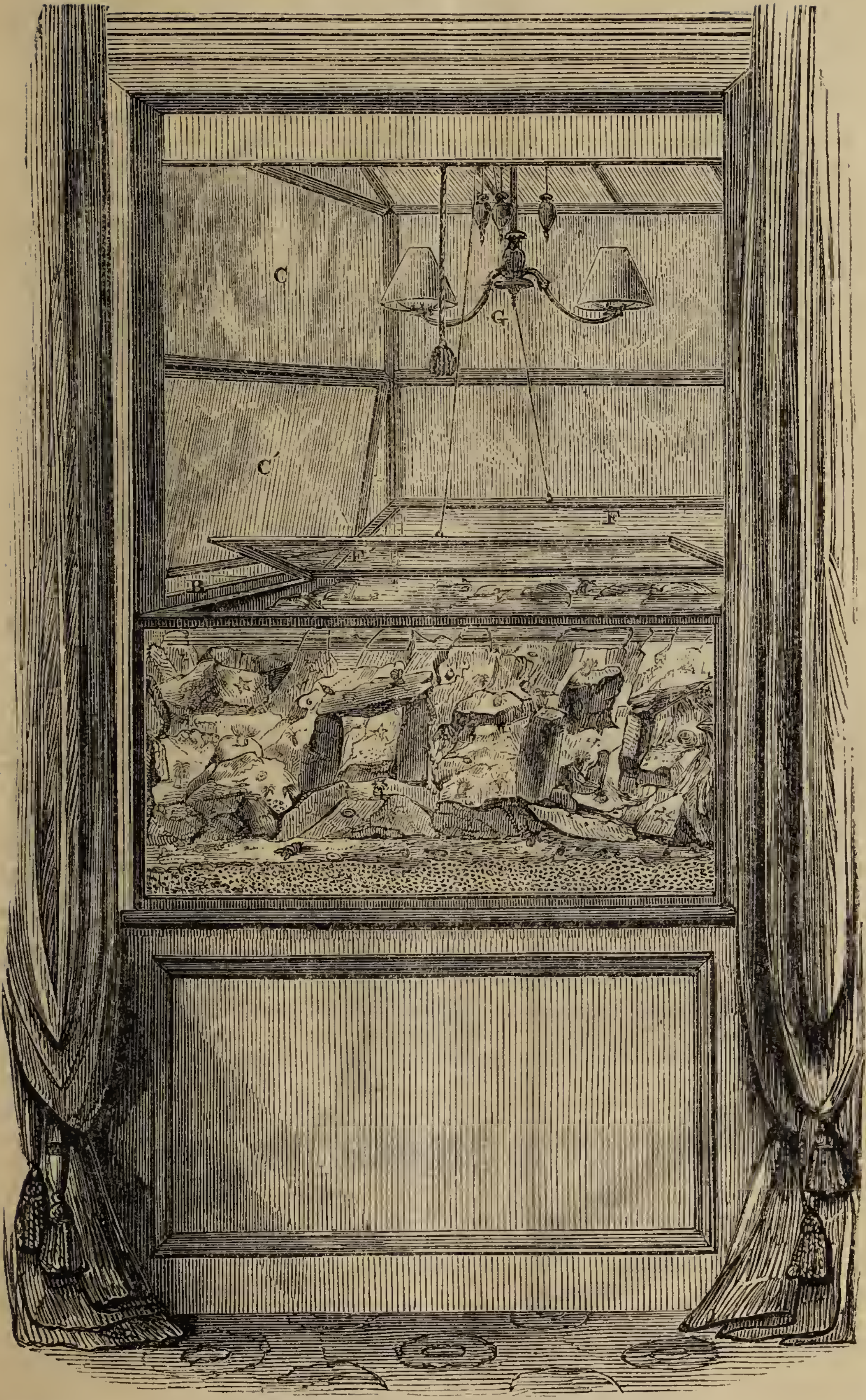
* The Tank from which the drawing was made stood in a garden (that, of course, being on a ground floor); but strong brackets may be made to support such a structure on any floor, and at any height.

Fig. 98.



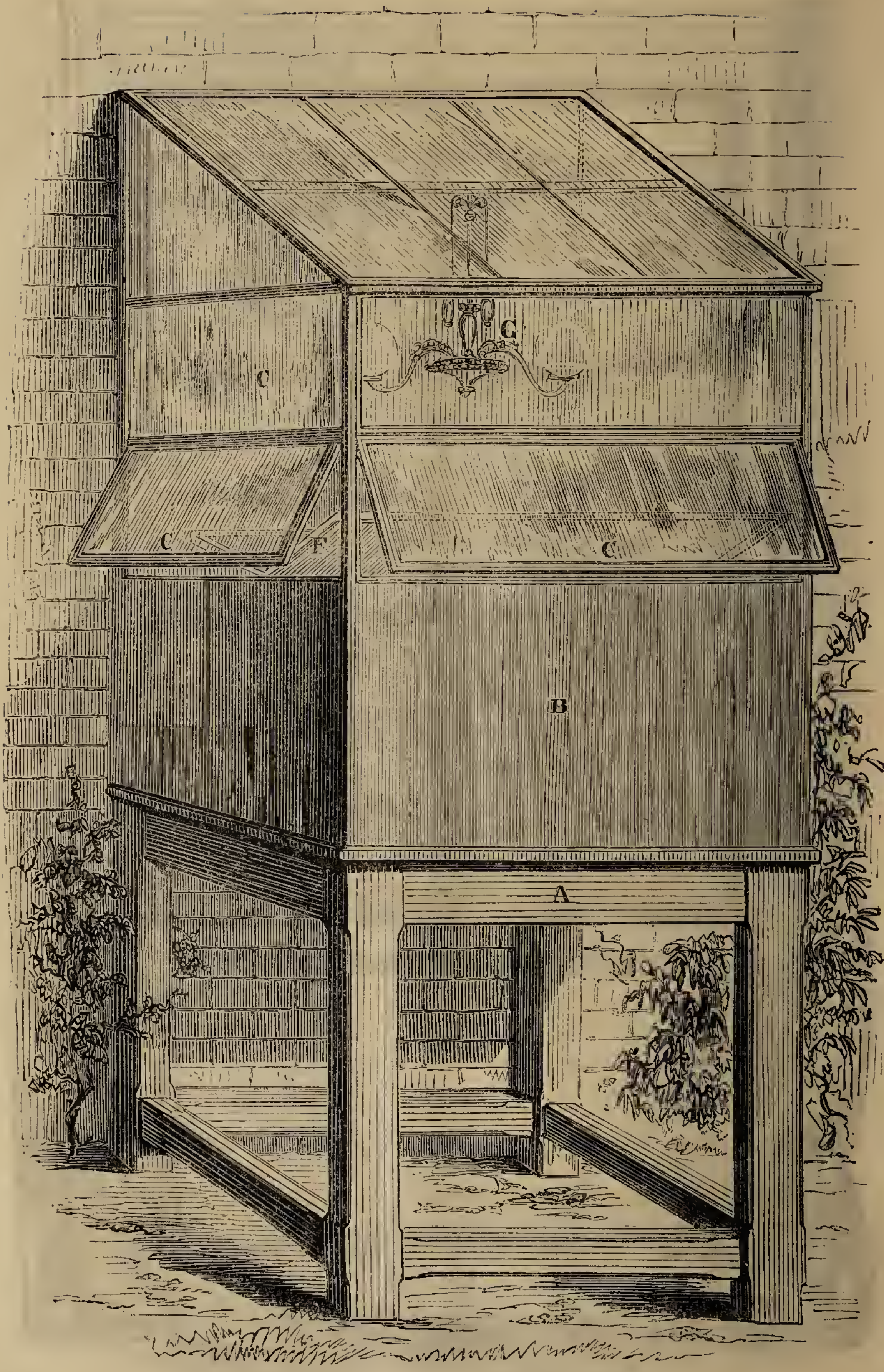
Sectional view of figs. 99 and 100.

Fig. 99.



[Front view, (seen from inside a room,) of figs. 98 and 100.

Fig. 100.

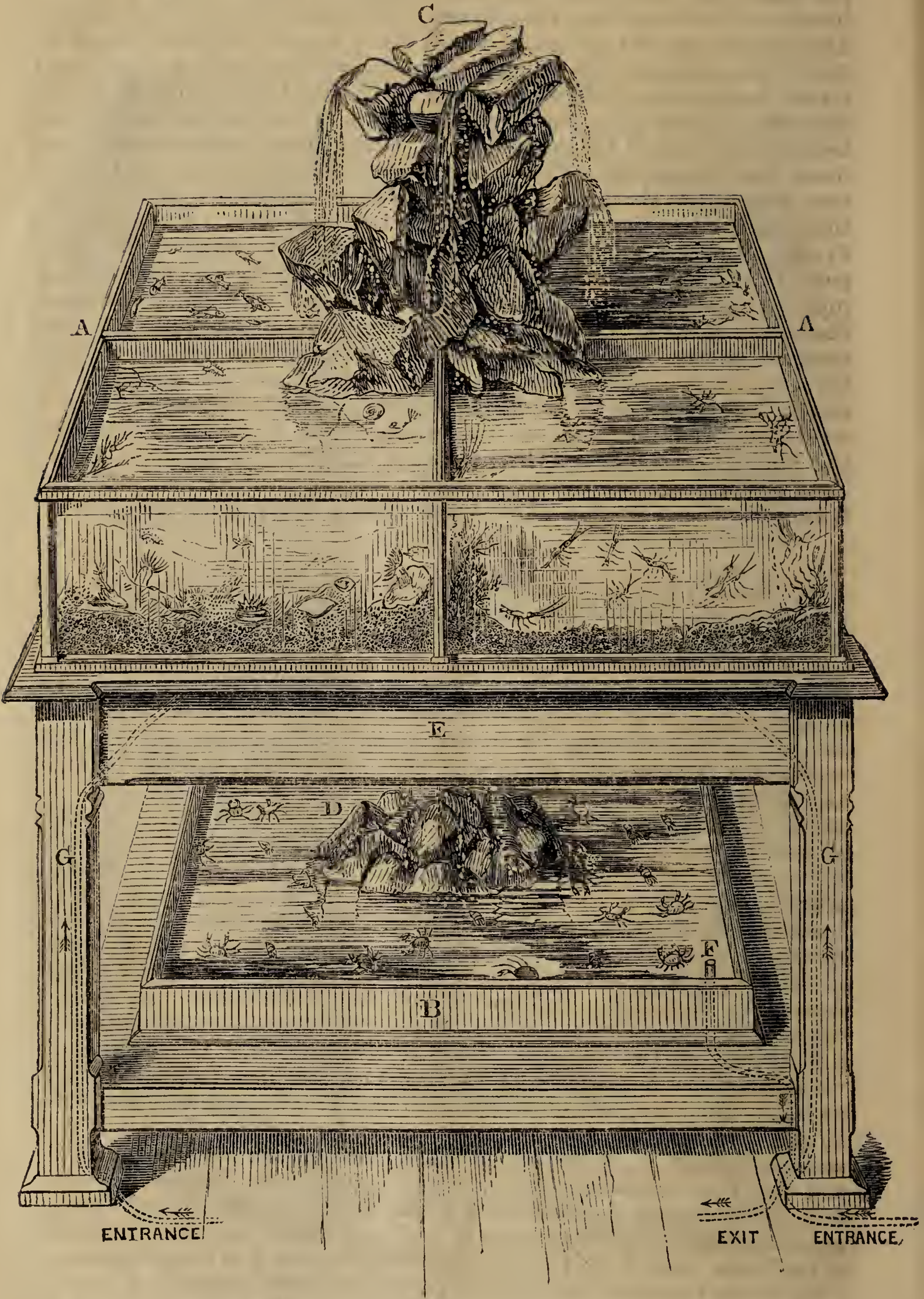


Back view (showing enclosure) of figs. 98 and 99.

whatever within a room, and yet be well seen from it. The one from which the engravings were made measured (inside) 48 inches long, 54 inches broad, and 24 inches high, these figures representing only the Tank portion. The erection was put up against a wall facing due east, and thus one of the ends of the enclosure was exposed to the hot south sun, which proved very trying during some weeks of the warm summer of 1859, and there was an objection, in point of appearance from a lawn, of a screen being interposed between the sun and the exposed end. Under these circumstances, it was found that the animals suffered, and that the depth of water in front should have been less, as the fluid would then have absorbed more oxygen in proportion to its bulk as the heat of the weather tended to cause it (the oxygen) to fly-off. However, a pump was fixed upon a platform placed on the lower part of the frame-work outside, in such manner that the end of the suction-pipe, terminating in the dark-chamber, D, and drawing water from thence, discharged it in a copious and well-oxygenated stream into the front chamber at the point B of fig. 99; and this, to some extent, obviated the imperfection referred to, though it would have been better if the stream had been less in volume and more *constant*, instead of being in action only while the pump was being worked. The engravings do not show this addition of a pump, as they were made before its adoption. Even a Tank of this large size is not adapted for keeping an indiscriminate collection of animals of varying dispositions, without a means of dividing them.

4. Fig. 101 represents an arrangement by which may be kept not only a large *number* of animals, but a great *variety* also, classified in compartments so as not to molest each other. A A is a Tank 60 inches square, and 12 inches high, having its base and two of its sides of slate, and the other two sides of plate-glass. Two slate partitions, crossing each other at right angles, divide the Tank into four equal compartments or cells. B is another Tank, measuring 48 inches square, and 6 inches high. In the centre of A is cemented a picturesque mass of rockwork, C, 20 inches high, and another mass, D, is piled to a lesser height in B. The whole is supported on a massive oak stand, E, strengthened internally in all directions so as to be very rigid. A slate cistern of 100 gallons capacity is placed in any convenient and cool place, and at any convenient distance, either in the apartment containing the Tank, or elsewhere, and at such a height that the base of the cistern is not less than 12 inches above the summit of C. A second cistern of 100 gallons capacity is placed in any convenient and cool place, so that its top is at a not less depth than 24 inches below the surface of B. A feed-pipe of half-an-inch diameter is conducted down from near the bottom of the upper cistern, and, near the floor, at the points marked "entrance," it is divided into two branches, each of three-eighths of an inch in diameter, which (shown in dotted lines, G G) run up the stand, and are concealed in its legs. Then they are subdivided into four branch pipes of a quarter of an inch diameter each, and these pass through four holes in the base of A A, and rise through C, at the top of which their orifices diverge outwardly, and they then discharge their contents equally over the rocks into the four divisions of A A, overflowing which, the water falls into B through pipes inserted in four other holes in A A, and finally run over the mouth of the "exit" pipe F, into the lower cistern, whence it is raised again once a day to the upper cistern, ready to perform another circuit, and thus the same water may be used continuously for years. The arrows express the direction of flow; and the system of circulation resembles in a measure

Fig. 101.



Compound Aquarium, with streams and tides.

that of the blood of animals. The mode of raising the water from the lower cistern to the upper is either by a pump constructed so as not to be injuriously affected by the action of sea-water, or better, by employing the pressure of a column of fresh-water obtained from a main or from an upper cistern as a motive power to lift a somewhat shorter column of sea-water. The operation is then effected without labour, and the fresh-water (of course, unmixed with sea-water) may afterwards be used for ordinary household purposes.

The value of this arrangement consists in the enormous oxygenating power provided by the combination of running streams and shallowness, and in the facilities it affords of keeping separate the creatures which cannot be safely placed together. Indeed, some zoophytes (such as *Tealia crassicornis*, *sagartia parasitica*, and *Anthea cereus*), most of the echinoderms, a great many annelides, not a few of the mollusks (especially those which give off much mucus), and a very large proportion of the crustacea and fishes, cannot be kept permanently and in satisfactory numbers, unless streams (and in many cases tides) and separate compartments or tanks are adopted. Sea-anemones, madrepores, and serpulæ, may be accommodated in one of the upper divisions of fig. 101; echinodermata can be housed in another; prawns and other swimming crustacea may live in a third; and fishes in the fourth; while the large lower shallow receptacle is well suited for hermit, shore, edible, and other non-swimming crabs. The water may be allowed to run over C in one, two, three, or four full streams; or they may be lessened to single drops by stop-cocks; while other stop-cocks are so contrived as to quite or partly empty any or all of the cells of A A, and so to give the great benefit of a *tide* to some of the creatures. As this apparatus is intended to occupy the centre of an apartment, where the admission of light is usually incidental and not direct, the portion A A is mounted on sixteen gun-metal rollers, moving on a circular iron tram-way fixed on the top of E, and provided with an iron pin and socket to keep the position central. By these means, all parts of the contrivance may be with ease turned in succession to receive any required advantages of light. A filter is sometimes placed between F and the lower cistern; and a refrigerator, for use in hot weather, can be interposed between C and the upper cistern; coolness being in some instances also attained by burying the lower cistern in the earth, so as to be free from local and seasonal influences of temperature.* In one instance where this circulating system was applied to an arrangement similar to that shown in figs. 98, 99, and 100, the advantage of being able to pump the sea-water from the earth cool and fresh, like spring-water, was so great, that, in July, 1859, when the temperature of the air ranged from 80° to 90° (a most destructive heat for creatures in Aquaria), the water in the Tank in question ranged from 55° to 60° only, and the animals were accordingly in a high state of vigour during that trying time. At Portland Road, an apparatus precisely similar to fig. 101, is employed to contain animals for sale, and as under such circumstances they are of necessity more crowded together than is ever the case in private collections, the success obtained may be accepted as a test of its great efficiency. On other parts of the premises the circulating principle is applied to shallow slate tanks or troughs, the water being admitted in a forcible thread-like jet at one end, and overflowing an exit pipe at the other. When these tanks and troughs are long enough, the separation of various animals is effected by the simple expedient of partitioning off the vessel by means of pieces of perforated glass held in position by rock-work. All these contrivances are now being used in private residences also. Streams (of water or of air), and tides, can be applied, too, to all or any of the tanks Nos. 1 to 15, pp. 60 to 61, either in conjunction with the stands there shown, or with pedestal stands made to enclose a portion of the apparatus, and this applies to any tanks already fixed and in working order, as well as to those which may be supplied after this date. Whenever it is not convenient to employ a head of fresh water as a force to drive up the sea-water, a condensing air-pump, worked by hand, may be used, and as the air is forced into closed vessels, the water is forced out of them. The compressing and receiving vessels are made purposely for this service, of strong chemical stoneware, and they may be had of any size, from 5 to 50 gallons capacity, at 1s. 6d. per gallon; from 50 to 100 gallons, at 2s. per gallon; and from 100 to 500 gallons, at 3s. per gallon, tested to bear a strain of from 30 to 60 lbs. on the square inch. These prices are exclusive of neck-fittings. Two of these stoneware vessels of 10 gallons each, will give a stream of one gallon an hour for ten hours a day, and this suffices for an Aquarium holding from 50 to 60 gallons of water, thereby much increasing its capability. Yet, be it observed, such an accessary apparatus is not needed in any aquarium when there is no intention to make it exceed its own special limit of operation, whatever that may be, this limit being determined and strictly adhered to. For instance, fig. 96, stocked as there shown, and well cared for, and placed in a cool and not sunny position, would need no stream; but tank No. 33, page 72, having the same number of creatures in it, *would* require a stream; because fig. 96 contains 1512 cubic inches of water, with 275 square inches of surface exposure, while No. 33 has 1870 cubic inches of water with only 187 square inches of surface exposure. Therefore the oxygenating power of H is double that of No. 33. Yet even the small capability of No. 33 would suit some animals—madrepores, for example—because they are of small size, and have not the smallest locomotion, and give off scarcely any substances to cause foulness in the water.

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* The two cisterns, the pump or other motive power, the pipes, the filter, and the refrigerator, are not shown at page 154.

As throughout this pamphlet so much stress is laid on the subject of temperature, it has to be stated, in conclusion, that there are three reasons for endeavouring to secure a low temperature in Aquaria:—

1. Because organic decompositions, aided by moisture, proceed at quicker rates at high than at low temperatures.

2. Because high temperatures prevent water from absorbing and retaining so much oxygen as low temperatures permit. Thus, a gallon of water (277 cubic inches) at freezing point, 32° Fahr. is capable of taking up 6·85 cubic inches of atmospheric air, but at 60° (a very good temperature for Aquaria) it will only hold 4·97 cubic inches of air; and with every increase of temperature there is a decrease of its power of holding air, until no animal can live in it.

3. Because vegetation in hot weather grows much faster than in cold weather.

Shallowness of water, and agitation of it, do not give aid by reducing the temperature of the water, but by giving air to it; and thus fishes sometimes live with comfort in water which is much heated *if it is also well aërated*, For instance, in the Zoological Gardens, Regent's Park, in July, 1859, a trout (a very delicate fish) was living at a temperature of 82° in a Tank 36 inches long, 15 inches broad, and 15 inches high, with a stream running through it. If there had been no stream, the fish would probably have died at only 70°; but if, in the same absence of the stream, the whole quantity of water were reduced to a depth of only two inches, the probability would have been that it might still have lived, even at 82°. The air dissolved by water and breathed by aquatic animals is always richer in oxygen than the ordinary atmospheric air breathed by terrestrial animals. *One-third* of the air absorbed by water consists of oxygen, instead of only *one-fifth* as is present in the atmosphere.*

CLEANING THE SIDES OF AQUARIA.

(*Reprinted from* NOTES AND QUERIES.)

WHAT is the best mode of removing confervoid growth from the sides of an Aquarium, so as to keep the glass quite clean ?—M. R. D.

We are indebted to Mr. LLOYD, who has done so much for lovers of natural history by his exertions in bringing to perfection the management of Aquaria, for the following remarks :—

Cleaning the Sides of Aquaria.—M. R. D is informed, in answer to a question respecting the "mode of removing confervoid growths from the sides of Aquaria, so as to keep the glass quite clean," that, as these growths are caused by the action of the desirable amount of light required (even if it be not in excess), and to which Aquaria are *of necessity* exposed in order to preserve the health of their inhabitants, it is not possible to maintain the glass in a state free from the growths in question, except by a course of vigilant, constant, and tiresome scrubbing, especially in warm, bright weather, when vegetation of these kinds proceeds apace. These observations, however, have application to all angular Tanks possessing two, four, or more sides of glass, when their figure is of any shape, and when their height equals or exceeds their breadth; and also to the whole tribe of vase and cylindrical glasses (such as "bell glasses," "propagating glasses," "confectioners' glasses," &c.) when converted into Aquaria. It has been proposed to remedy the evil by the use of blinds or curtains of variously-coloured substances, but this is found to be ineffectual, as it excludes the light too much, and so in a great measure stops the evolution of oxygen. In short, with such vessels, the attempt to obtain *sufficient* light and vegetation is attended with the annoyance of getting *too much* light and vegetation. The employment of certain plant-eating snails, both marine and fresh-water, to consume the conferva, has also been recommended; but the creatures are too wayward in their habits to be of any practical service. These considerations have, during the last two years, led to the very general abandonment of the Tanks and vases of the kind described, and have brought into use other and better forms of Tanks, in which (without any impediment to a distinct view of the interior) three sides are of slate, covered with rock-work, which slopes backward and upward from the front; *and this front is alone of glass*, and is reduced to such dimensions that the preservation of it in a perfectly clean and bright state is a matter of no difficulty. The conferva may thus be *encouraged* to grow upon the interior of the opaque sides to an extent which is quite under control; and so far from the growth being unsightly in such a situation, it is converted into a direct benefit, both as regards its appearance to the eye, in covering the rock-work with verdure, and as respects its presence as necessary to decompose the carbonic acid gas given off from the animals; for it is certain that no vegetation evolves oxygen so copiously as conferva and the other plants which come spontaneously in Tanks. Of conferva, indeed, it may be said, as it is said of fire, that it is "a very good servant, but a very bad master." Let such a vessel, therefore, be chosen for Aquarian purposes as will permit the conferva to grow without being an annoyance, as it is on transparent surfaces. It need not even then be permitted to grow too freely, as a newspaper or a handkerchief thrown over the glass cover of the Tank, or over a portion of the cover, during the sunniest portion of the day, will effectually keep it under command. There need be no fear that any such moderate checking of growth as this will have an ill effect on the animals, if the vessel is also so *shallow* as to expose a comparatively large surface of water to the atmosphere, and so to be enabled to absorb oxygen from that source as well as from vegetation. This regulation of growth is further to be carried out by choice of aspect. Thus, in summer, windows facing the south, south-west, south-east, and west, should be avoided, as being unfit for the reception of Aquaria, and those having a northern, north-eastern, or north-western exposure should be adopted.

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* At page 146 it is stated that decomposing organic matters are "*consumed*" in water by the action of oxygen upon them, and this word is chosen to express the sameness of principle which exists between the combustion of certain substances effected by the influence of fire in a furnace or grate, and that caused by exposure in an Aquarium; for in both cases the substances are consumed, or altered, by being made to unite with oxygen. In an Aquarium, decomposing organic substances are made to combine with oxygen at a low temperature, and by the agency of water, in the same manner as other substances combine with oxygen, in a furnace at a high temperature, and through the medium of fire. And as the value of a furnace depends upon the rapidity with which its fuel can be made to unite with oxygen, so the value of an Aquarium is determined chiefly by the quickness with which *its* fuel (dead organic matter) can be made to combine with oxygen. Thus, when in an ordinary grate, it is wished to make the fire burn brighter, it is stirred up, that is to say, fresh surfaces of the fuel are exposed to the action of the flames and of the air which feeds them, and openings are made through which the oxygen in the surrounding atmosphere can more perfectly enter the mass and combine with it. Precisely the same thing occurs when an ordinary Aquarium is stirred up gently, or syringed, for thereby the union of oxygen with organic substances contained in the water is much quickened, and they are more speedily rendered harmless. When very obdurate substances have to be acted upon by fire, its heat is rendered more intense by urging into it a stream of air—for example, in the case of a blacksmith's' forge. The arrangement is then a blast furnace, and the principle by which its greater heat is obtained consists merely in securing a very rapid combination of fuel with oxygen, by giving a more copious supply of the latter. So in an Aquarium, when it is wished to keep difficult animals, or a large number of animals in a limited compass, one of the means made use of to secure the end in view is to propel into the Tank containing them a stream of oxygenated water, by which the decomposing organisms given off from the animals are very quickly made to combine with oxygen; or, in other words, they are rendered harmless by being thus "consumed." In some steam-engine furnaces, when the steam is required to be generated with unusual quickness, the fire is spread over large surfaces, *i.e.*, the oxygenation is made to act on many points at once, and the water in the boiler being likewise spread out, it is very quickly heated. And this is exactly analogous to the increased and more speedy oxygenation obtained in Aquaria by the exposure of large surfaces to air.

M. R. D. is further informed that an excessive growth of conferva does not stop by merely covering the glass of the objectionable Tanks first mentioned, but it also converts the whole of the once clear water into a brownish-green opaque mass, much resembling pea-soup, and this very often in a short time, if the light be strong and the weather hot. The cure for this has been found to consist not only in the employment of vessels having their transparency and height much diminished, but in the formation in them of a chamber to which a part of the water has access, and which, being thus kept constantly in a state of *entire darkness*, is also in a condition of *complete clearness*, and yet, by its being ever in active communication with the other part of the water, not in the dark, it, by a compensating action, maintains the whole of the fluid in a perfectly limpid condition.

These various improvements have been gradually effected since the autumn of 1857, and they have given to Aquaria a systematic certainty of action never before realized or even thought of.

W. ALFORD LLOYD.

MARINE AQUARIA.

(*From the* ATHENÆUM *of December* 10, 1859.)

Remembering, seven or eight years ago, how much was done by the *Athenæum* in calling attention to Aquaria as desirable means of preserving and studying, in a living condition, the numerous plants and animals which can be maintained in Tanks, and more especially the *marine* organisms which (since about the period 1841, the date of the late Prof. Edward Forbes's "History of British Starfishes,") have received so much attention in this country, I now write to point out the absence of a series of *worthy* Aquaria in every establishment, whether in the hands of private persons, or belonging to Societies, or under the auspices of Government. Even the Tank-house of the Zoological Society of London, in Regent's Park, is no exception to this statement; for the arrangements there adopted are now, confessedly, very ill-designed for the purposes in view. It was built under the superintendence of the late Mr. D. W. Mitchell, at a time when very little was known about the subject; and no precedent existed for anything of the kind. Certain plants were known to give off a supply of oxygen while under the stimulus of light, and this oxygen was known to be required by the animals associated with the plants; and thus it was imagined that if a collection of any living vegetables and creatures were placed together in any vessel, they would at once, and with scarcely any trouble, be rendered mutually self-supporting, It was soon found out, however, that this crude theory required to be modified to so great an extent, and that it demanded to be associated with so many other conditions, that the conservatory-like building now standing in the Gardens, was discovered to be, in the first summer of its existence, an arrangement so utterly wrong, that the modifications it demanded would amount to something like an entire re-construction. This was because of the acceptance, exclusively, and in too great a latitude, of the old formula of *plenty of light;* forgetting, however, how small is the amount of illumination obtained by plants and animals in the sea, and quite overlooking the fact that, out of the sea, and upon land, a great amount of light is usually accompanied by much *heat*, while, in the ocean, the temperature around Britain does not vary, at any season, much from 60° Fahr. In the fish-house of the Zoological Society, however, the range is, or may be, from about 30° to upwards of 90°. On the 13th of July last, at four o'clock in the afternoon, the thermometer in the *house* stood at 93°, and in the *Tanks*, with a free bulb immersed in the water, it was 82°. Nothing in the shape of animal life, planned by Nature for an equable and moderate temperature, can long resist the destructive effects of such a heat as *that*, or, if some of the hardier kinds *do* manage to exist in it their health is surely deteriorated. The result to the vegetation is equally disastrous. Natural water, and especially sea-water, is so full of germs of plant life, that, when such water is exposed to light, the minute locomotive plants of the humbler kinds, or the spores of the higher plants, are rapidly called into visible existence; and if the exposure to light and heat be long continued, the water becomes so full of these atoms as to assume a dense and opaque greenish-brown colour, rendering all within the Aquarium invisible, or nearly so. A few summers ago, the excessive amount of light was in some measure subdued by a covering of tarpaulin, though the heat yet continues, as before shown, nearly as great as ever. But another radical defect then became apparent—namely, the too great height and too narrow breadth of the Tanks themselves, the result of this being that the surface of water presented to the oxygen of the atmosphere was disadvantageously little—so little, indeed, that it may be fairly calculated that not more than 30 per cent. of the bulk of fluid employed is rendered available for the animals kept in it, and the means do not exist of re-supplying oxygen as fast as it is consumed. It seems to be not remembered that the oxygen derived from growing plants is serviceable as an auxiliary only to the oxygen obtained directly from the surrounding air, and that the attainment of this last mentioned condition must depend mainly upon the form and proportions of the Tanks adopted, and should therefore be a primary, and not as at present a secondary consideration. And the consequences of the neglect of this law are, that not only a certain limited number of slow-breathing animals can be permanently maintained, and that a vain attempt is constantly being made to keep other and more numerous and more highly-organized creatures by a weekly change of sea-water (in most of the larger Tanks), throwing away the old water, and supplying a new lot. Now, this is a piece of tremendous extravagance; and it becomes simply a matter of figures to show how the hundreds of pounds thus spent idly and fruitlessly by the Society in the last seven years might have been expended in building another and a better Aquarian house. Sea-water never becomes deteriorated in any way by any amount of using or keeping or filtering; so far from that, indeed, it improves by age, and therefore, had it been thought of, the couple or three thousand gallons or so, purchased for the Gardens in 1853, might have been in use up to this hour, without diminution of volume or alteration of any of its qualities for Aquarian purposes. Of course, no one is to be blamed for all this, nor for the corresponding paucity of specimens incidental to the system, because no one pointed out the evil till the mischief was done; yet, now that the thing is so apparent, steps should be taken to remedy it.

This state of affairs in the Aquarian management of the Zoological Society of London is dwelt upon, because it is a type of that which exists nearly everywhere else. At the Crystal Palace, Sydenham, the Aquaria are a very long way below mediocrity. Nothing can be much worse than the murky abortions containing gasping fishes, flabby sea-anemones, and weak-legged crustaceans, at public museums at Scarborough, Weymouth, Dublin, Belfast, Edinburgh, Hull, Galway, and other places. Our South Kensington Museum contains one Glass vase toy Aquarium, and one wretched leaky Tank. The Botanic Gardens at Kew—so universal in their aim—have no marine Aquaria at all. The Botanic Society in the Regent's Park has nothing of the kind, but it would not be easy to say why.

An opportunity now occurs, however, of doing something much better than has ever yet been attempted; for the Horticultural Society is engaged in building extensively; and it would be easy, and not out of the scope of that Society, to combine a really effective Aquarian building with the other works now going on. Matters are not now, happily, as they existed a few years ago, when only a bare handful of crude conjecture was all that was known of the science of the conservation of the lower living aquatic plants and animals. On the contrary, accurate, certain, and full information may be obtained as to the best mode of procedure, in such manner as to reduce the chances of failure to a very small compass.

W. ALFORD LLOYD.

Since the foregoing paper was published, the Imperial Society for Acclimatation of Animals, at Paris, has resolved to construct some Aquaria worthy of a public body and of the French nation, and the writer of this is entrusted with their erection. The house for the purpose (in the new Zoological Gardens in the Bois de Boulogne) is a substantial stone building, about 110 feet long and 25 feet broad, arranged specially with a view to the attainment of coolness in hot weather, and lighted wholly from the north. The Tanks (on the dark-chamber principle, which is patented in France) are now (August, 1860) made and fixed. They are fourteen in number, each being six feet long, four feet broad, and two feet three inches high. Of these, six are for fresh-water, and eight for sea-water. All of them will contain streams of water in addition to the oxygenation supplied by vegetation and by large surfaces. The marine Tanks will be provided with streams of sea-water issuing directly from underground reservoirs, without having to pass into any upper cisterns, and the degree of coldness secured by this plan will be very great and constant. Provision is also made for *tides.* The motive power will be merely that of a stream of fresh-water obtained from a high-pressure main, it being employed in forcing up the sea-water. The arrangment will be so nearly self-acting, that the whole of the immense mass of upwards of 4,000 gallons of salt water, weighing about 18 tons, can in course of a few hours be lifted up from a depth of 14 feet with any required force (within the limits of the fresh-water pressure), passed through the Aquaria, and returned to the earth to be used again, with no more labour or expense than the turning of a few stop-cocks, once daily, and without loss or deterioration. The animals will be classified according to their habits, and the atmosphere which the water will absorb, will not be the heated and vitiated air breathed by a crowd of visitors, but the cool fresh air of the Gardens. No light can enter the visitors' portion of the building except through the Tanks, and there will be no view of anything external to the house. Thus, only the contents of the Aquaria will be seen, and without the marring effect of an incidental illumination. A full account of this undertaking, with illustrations, will be published on its completion.

RECAPITULATION.

1. Aquatic plants require a supply of carbon; and this is obtained, partly from the carbonic acid gas existing in the atmosphere—and which is absorbed by the water,—and partly from the carbonic acid gas evolved from the breathing of animals. These animals, in a minute form, cannot be absent in any vessel of water which for some time has been exposed to the action of light and air.
2. Aquatic animals require a supply of oxygen; and this is got, partly from that which exists in the atmosphere—and which the water absorbs,—and partly from that which is set free by the plants when they absorb carbon, in the act of decomposing the carbonic acid gas. These plants, of minute kinds, cannot be absent in any vessel of water which for a short time has been exposed to light and air.
3. These two sets of operations are thus self-supporting; and an Aquarium is an arrangement in which they may be conveniently exhibited and controlled, and in which is kept, on the same principle, larger creatures than those which appear spontaneously.
4. Water of itself cannot support life; it is only a vehicle for containing that which *does* sustain existence.

5. Water, in an Aquarium, is indestructible; and any dead organic matters found in it may be rendered harmless by their combination with oxygen. No change or waste of water is needed, therefore.

6. As the oxygen obtained from the atmosphere direct is that which the animals mostly depend upon, the form of the Aquarium should be that which admits of a large surface of water in contact with the atmosphere.

7. The proportions found to be best are those represented by Tanks 1 to 15, page 60 to 65, and by Tanks A to H, page 145.

8. Vegetation cannot be dispensed with, as it alone decomposes the poisonous carbonic acid gas given off from the animals. Atmospheric air without plants cannot perform this office.

9. Yet plants must not be depended upon for doing more than this.

10. Thus, an Aquarium in which the surface of water is small, in comparison with its cubic bulk, is found to be unsuccessful in keeping animals in satisfactory numbers, however luxuriant the vegetation may be.

11. And, on the other hand, an Aquarium in which the surface is large, and the cubic measurement small, is *also* found to fail in the maintenance of animals, if vegetation is absent.

12. Therefore, before animals are placed in an Aquarium, plants should be present. It is not enough, however, that the plants be merely *imported* and placed in the Aquarium: they must be *indigenous* to every individual Tank, actually grown within it, and minutely covering all opaque portions of it, and all surfaces of the rockwork exposed to light. If picturesqueness of appearance is desired, it should be sought, not in the size of the plants, or in their distribution, but upon the generally good arrangement of the rock-work, and the clearness of the water. It is contrary to good taste to introduce colour in rock-work, or to attempt any decorations in the shape of pieces of coral, ornamental shells, pretty pebbles, bits of coloured glass, minerals, &c. Still worse is it to employ built-up ruins, or trifling grotto-work of any kind.

13. Beyond merely indicating the future growth (see fig. 92), vegetation should be grown simply by taking advantage of the universal tendency of plants to appear spontaneously, wherever light, water, and air are brought together.

14. As this growth is persistent, as the plants decay periodically, and as an Aquarium contains but a limited quantity of water, the vegetation should be kept always at a minimum, by regulating the light.

15. Only one side of an Aquarium should be of glass; and the vegetation may then be allowed to form on the three opaque sides with advantage.

16. Sunlight should never fall on an Aquarium. The animals are killed by the heat, and the water is rendered turbid by it.

17. Fishes and other active animals should not be kept in any but very large Tanks. Sea-anemones, corals, echinoderms, serpulæ, mollusks, and other low forms of marine life, are not only easily maintained, and very interesting, but the imprisonment of them is less cruel than that of any other animals known.

18. All animals require food. Those which take food involuntarily (i. e. in the act of breathing) only need a sufficient supply of oxygenated water; but those which demand to be fed by hand must be fed regularly and properly. The whole of the food so given is seldom wholly absorbed by the animals; and, as they have no means of removing uneaten or partially digested food, it must be taken out by hand, or it will speedily poison the water, which is circumscribed in quantity and in means of oxygenation. See page 147.

19. The temperature of an Aquarium which has no stream or motion given to the water, should be from about 45° to 60° Fahr. There is safety up to 65°; but with a stream and motion, 70°, 75°, or even 80° may not be feared.

20. Therefore, whenever a stream can be conveniently managed, the Aquarium gains much by it; and the circulation of a current of sea-water can be easily and cheaply attained, wherever there is a cistern of fresh-water to be used as a motive power. If this cannot be done, then the fresh-water may be used, with still greater ease and economy, to propel a current of *air* through a marine Aquarium.

21. In the absence of any of these more permanent means of aëration, a condensing air syringe may be fixed to the stand of any Tank; or a common syringe may be used, as shewn in fig. 58. But, whatever may be the means employed, they should be *gentle*, and not those which disturb the animals, or stir up the sediment which exists in every Aquarium.

22. If glass vessels are used for Aquarian purposes, it is desirable to limit them to the capacity of one quart, so that they may be easily removed to suit varying circumstances of light and temperature. But such glasses require much care in management, and they are only adapted to contain one or two specimens kept for some special purpose, or for miscroscopic objects.

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"This book, although neither more nor less than a 'trade-list,' produced mainly for the benefit of the dealer, cannot fail to be very useful to all who study that which we described as 'a new pleasure'—the collecting and arrangement of sea-produce in homes far distant from the sea. This pursuit has of late years become almost a passion. In nearly all our ports there is some sea-monster in human form whose business it is to ramble over rocks at low tides, or dredge when wind and tide both serve his purpose, in order that packages may be made up, to send by express train to London, containing numerous sea-things, which Mr. Lloyd will distribute next day among his thousand customers. An absolutely new trade has thus been established to minister to this new pleasure, and Mr. Lloyd has at length printed a book for the guidance—the sure and safe guidance—of those who indulge in it. Mr. Lloyd does not, indeed, tell us—it is not likely he would do so—who and where are his *employés* along the coast; but this is almost all he conceals, for he is open, frank, and honest, in communicating information by which those who have may keep alive in health the actiniæ, sea-weeds, &c., they may have collected or purchased.

As we are among those who have bought experience, we are bound to state that a shilling expended in acquiring this book would have saved us pounds; for Mr. Lloyd makes it very clear what we ought to do, and what we ought not do, if we desire our tanks to be clean, healthy, and encouraging, and to render the aquarium, either of the salt or the fresh-water, a continual source of enjoyment, and not a perpetual disappointment and mortification; and undoubtedly he who carefully reads this little book will have himself only to blame if he has to endure the frequent annoyance of deaths among the inhabitants of his mimic ocean.

We might go at much length into this matter, but we cannot afford the requisite space. We recommend the publication, and Mr. Lloyd also, as an intelligent guide and an equitable dealer."—*Art Journal*, October, 1858.

"Although this is professedly a trade list, it contains so much information with regard to stocking and managing aquaria, that we have no hesitation in recommending it to those who are interested in the domestic culture of water-plants and animals. Although Mr. Lloyd is now a successful merchant in all forms of life that can be cultivated in the aquarium for scientific observation or amusement, he began his career as an amateur, and has by much labour and study done perhaps more than any other individual for facilitating and perfecting the management of marine and fresh-water plants and animals. This list contains a large number of useful illustrations, and a quantity of matter, in the form of notes and observations, which every one having an aquarium cannot but find of use. Mr. Lloyd's experience is very great, and he has freely communicated it in this unpretending production."—*Athenæum*, February 12, 1859.

"As 'Notes and Queries' was, we believe, the first journal to call attention to Mr. Alford Lloyd as a diligent naturalist and a purveyor of specimens for those who desire to follow that interesting branch of study—nature in aquaria—and that, long before the pursuit was so much in vogue as it is at this moment, we have especial pleasure in recording the success which has attended his endeavours to popularise this study, as shown by his recently published *List, with Descriptions, Illustrations, and Prices, of whatever relates to Aquaria.* When we add that this List occupies 128 pages, with 87 wood-cuts, and gives prices of thousands of objects, it will be seen how useful—we may add indispensable—it is to all who have, or propose to have, an aquarium."—*Notes and Queries*, September 25, 1858.

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* * *

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